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ELECTRONICS AND ELECTRICAL ENGINEERING

No. 53

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USSR REPORT

ELECTRONICS AND ELECTRICAL ENGINEERING

No. 53

This serial publication contains articles, abstracts of articles and news items from USSR scientific and technical journals on the specific subjects reflected in the table of contents.

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USSR UDC 621.373

A HIGH-SPEED DIFFERENTIAL AMPLIFIER WITH DISCRETE COMPONENTS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 4, Jul-Aug 79 pp 157-158 manuscript received 13 Mar 78

ANTONEVICH, A. I., BUTSKIY, V. V. and VETOKHIN, S. S., Belorussian State University, Minsk

[Abstract] A 3-stage differential amplifier has been built with discrete components for signal voltages rising at a rate of 40-50 V/μs and a voltage gain of 1000. The first stage is an emitter follower on a pair of transistors stabilized with a diode and three resistors, the second stage is a cascade differential microcircuit with a low dynamic input capacitance and a high cutoff frequency, the third stage is a high-gain differential amplifier circuit on a pair of 2-gate MOS transistors. The device has been designed for input currents below 1 nA and output voltages within the $\pm$8 V range. The open-lopp upper cutoff frequency is 1.75 MHz and the temperature drift, referred to the input, is 100 mV/°C. Its amplitude-frequency and phase-frequency characteristics must and can easily be corrected for operation with negative feedback. It is tuned with a variable resistor in the first stage and by zero potential setting at the output. Figures 1; references 2: 1 Russian, 1 Western.
[18-2415]

USSR UDC 621.375:681.586.34

WIDE-BAND PREAMPLIFIERS FOR OPERATION WITH PIEZOELECTRIC PICKUPS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 6, 1979 pp 31-32

VOZZHAYEV, V. G.

[Abstract] When acoustic signals are studied in solid-stage,piezoelectric transducers having different characteristics are used; they generally have high input impedance at the highest output. With weak acoustic signals, voltage at the output of the piezotransducers is extremely small, so the measuring device must be highly sensitive. Because the meter can not be placed in the immediate vicinity of the test object, the signal must be transmitted over a long cable having high capacitance-per-meter: the signal source is shunted and there is interference at high frequencies. Leads of minimum length are used to connect preamps and pickups to match impedances and increase signal-to-noise ratio. Preamplifiers must have high input impedance, low input capacitance, negligible noise in the test

frequency range, wide bandpass, low output resistance, minimum power supply voltage and minimum connection lead lengths. A group of preamplifiers with FET input stages was developed that adequately meets these requirements. If noise specifications are critical, FETs with p-n control junction are used in the input because their basic noise component over 10 kHz is thermal noise. FETs with insulated gates (MOSFETs) at frequencies under several megahertz have other noise components exceeding thermal noise. Three preamplifiers are shown for different frequency ranges: 2×10^4 to 3×10^6 Hz; 5×10^4 to 2×10^6 Hz; and 50 to 2×10^4 Hz. Figures 3.
[241-8617]

USSR

STEREOPHONIC AMPLIFIER

Moscow RADIO in Russian No 7, Jul 79 pp 32-33

NIKOLAYEV, A. and CHERNYKH, YU., Moscow

[Abstract] The article describes a stereo amplifier that operates from ceramic and magnetic pickups, tuners, tape recorders and other low-frequency signal sources. The output power is 70 W per channel at 20-20,000 Hz on a load impedance of 4 Ohms. Input impedance is at least 50,000 ohms. Noise level is -65 dB from the input of a magnetic pickup, and -78 dB from the input of other signal sources. Tone control range is from -16 to +12 dB on 40 Hz and from -20 to +18 dB on 18,000 Hz. Crosstalk attenuation between channels is -35 dB on 20 kHz. A schematic diagram of one of the channels is given. Figures 1.
[279-6610]

USSR UDC: 621.396.67

ANTENNAS FOR RECEPTION OF TELEVISION SIGNALS IN THE MOUNTAINS

Moscow ELEKTROSVYAZ' in Russian No 7, Jul 79 pp 8-9 manuscript received 9 Jan 79

KUKAYEV, A. A.

[Abstract] Special antennas with good directionality characteristics can improve TV reception in mountainous areas, reducing the prevalent ghosts. Multiple-element "wave channel" antennas, synphase antennas and complex phased antennas consisting of several "wave channel" antennas are all effective in this respect. In addition to the electronic considerations, the pecularities of weather in the mountains must also be considered in selecting antenna types. Antennas must be designed to operate at low temperatures, in fog, under exposure to strong sunlight including a high ultraviolet component, and supporting structures must be highly wind resistant. References: 2 Russian.
[274-6508]

USSR

ANTENNAS WITH ELLIPTICAL POLARIZATION

Moscow RADIO in Russian No 7, Jul 79 pp 12-13

KHARCHENKO, K., candidate of technical sciences, Leningrad

[Abstract] An elementary explanation of antenna polarization is given in terms of orientation of the electric vector of the electromagnetic field. The technique used for measuring parameters that determine elliptical polarization is described. An analysis is made of two cases relating to communication via satellite relay with matched antennas with elliptical polarization. Figures 8.
[279-6610]

USSR UDC: 53.072:51

BEHAVIOR OF INTERACTING AUTOMATA MODELING A SYSTEM CONSISTING OF A CONTROLLED OBJECT AND ITS CONTROLLER

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 7, Jul 79, pp 113-121 manuscript received 26 Apr 78

IVANOV, N. N., Moscow

[Abstract] Behavior in a closed loop consisting of two synchronous finite automata is studied for the case in which no limitations are placed on the automata. The task of synthesis of the controller is studied, assuming the set of input-output sequences to be actualized in the controlled object to be assigned in a language of equivalent transforms. Necessary and sufficient conditions for possibility of actualizing the sets in the controlled object are produced both for the general case and for the particular case of a deterministic controller. Algorithms are suggested for testing the possibility of actualizing a given set of input-output sequences in the controlled object, and for synthesis of the controller given certain limitations. Figures 4; references 5: 4 Russian, 1 Western.
[284-6508]

USSR UDC 62-50

AN INFORMATION-COMPUTATION SYSTEM FOR PROCESSING AND STORING OF OCEANOGRAPHIC DATA

Kiev AVTOMATIKA in Russian No 1, Jan-Feb 79 pp 57-61 manuscript received 24 Mar 78

TSIPIS, YA. L., GUBENKO, N. D. and KUKUSHKIN, I. B., Main Computation Center, Central Statistical Administration of the USSR

[Abstract] An information-computation system is described which will serve the oceanographic research and, in accordance with the requirements for this application, will provide a huge storage capacity with means of regular and almost unlimited supplementation (doubling of the volume every 2-5 years). The data bases satisfy the characteristics of relational models in that they are normalized, ordered according to key elements and have a linear structure. The system must also provide for automation of the problem formulating process, for analysis of intermediate results and formulation of new undergoals, for automation of the problem solving process, for storage of the results of preceding processing stages as required, for partial automation of the interpreting process, and for data output in any

desired form. All this requires a system of appropriate languages. The structural components must furthermore include, in addition to a data bank with control and a bank of processing algorithms, also means for manipulating the data and organizing the problem solution process, means for information readout and man-machine communication. This information-computation system will be program-controlled from a Unified System disk operating system, with the vocabulary and the syntax checked according to the respective language and the semantics checked against description tables, information collected and sorted according to appropriate programs, then the interface organized and, after final data processing, the results read out. Further elaboration of the system language facilities and software components is a prerequisite for ensuring that the system will perform its tasks. Figures 1; references 5: 3 Russian, 2 Western.
[3-2415]

USSR UDC: 62-50

OPTIMAL SUBDIVISION OF A SYSTEM INTO SUBSYSTEMS

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 7, Jul 79 pp 103-112
manuscript received 22 May 78

MOISEYENKO, G. YE., Moscow

[Abstract] This work, a continuation and development of an earlier work, formulates the task of subdivision of a system into subsystems in general form using functions of closeness (force of connection) and complexity of the subsystems. Necessary and sufficient conditions are produced for optimality. The concept of relatively and absolutely stable systems is introduced, in which the force of internal connections of any subsystem with other elements of the system exceeds the force of external connections of the subsystem or the system as a whole. It is shown that due to the relatively closed nature of connections of absolutely stable subsystems, these subsystems can be considered indivisible in any search for the optimal subdivision. A number of problems of subdivision into stable subsystems are studied, and an algorithm is suggested for searching for stable subsystems. Figures 3; references 10: 7 Russian, 3 Western.
[284-6508]

USSR UDC: 62-83

AN ELECTRONIC SYSTEM OF CYCLICAL PROGRAM CONTROL OF DRIVES (ESTSPU)

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 7, 1979 pp 5-6

MARINOCHKIN, A. I., PODSTAVKIN, N. K. and FUTERMAN, YU. M., engineers

[Abstract] The ESTSPU electronic cyclical programmed control system developed at "Elektrostal'tyazhmash" Plant is described. The system is intended to control objects whose operating algorithm can be described by boulean functions of time. The system can replace any relay automation system, and consists of input-output devices plus one control device. Each input-output device consists of information input and information output subunits, a multiplexer and a power supply. Each input-output device can support up to 16 inputs or outputs, each of which can, in turn, be switched among any one of six units. The technical characteristics of the modular system are briefly outlined. Figures 1.
[283-6508]

USSR UDC 62-501.42

NEW RESULTS ON THE ABSOLUTE STABILITY OF NONSTATIONARY CONTROLLED SYSTEMS (SURVEY)

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 8, Aug 79 pp 29-48

LIBERZON, M. R., Moscow

[Abstract] Remaining unsolved is the problem of the necessary and sufficient conditions, convenient and effective for engineering calculations, for the stability of nonlinear nonstationary systems of an arbitrary order of magnitude. The problem of determining these conditions is one of the most important problems in the theory of automatic control. In the last 10 years a great number of studies have appeared on the absolute stability of controlled systems, different formulations of the problem have come about and new definitions have been introduced. A survey is given here of studies on the absolute stability of nonstationary continuous automatic control systems, drawing from material printed in Soviet and foreign periodicals from 1968-1977. The concept of absolute stability has been broadened to embrace the following definition: Let an automatic control system be described by equations whose right halves include certain functions of generalized coordinates of the system and time, $\phi_i(x,t)$, $\phi_i(0,t) = 0$, about which it is only known that they satisfy the usual

conditions for the existence and uniqueness of a solution to the system and belong to a certain class of functions, Φ. The system is termed absolutely stable in class Φ if the zero solution, x = 0, is asymptotically stable as a whole with any choice of function ϕ_i from class Φ. In the case of a linear dependence of functions $\phi_i(x,t)$ on x, i.e., with $\phi_i(x,t) = u_i(t)x$, the system is called parametrically perturbable, and when absolute stability is investigated randomness is assumed in the selection of nonstationary functions $u_i(t)$ from a certain fixed class of functions. In the majority of studies devoted to nonlinear nonstationary systems the absolute stability of systems of the following form is studied: $\dot{x} = Ax + b\phi(\sigma,t)$, $\phi(0,t) = 0$, $\sigma = (c,x) = \sum_{i=1}^{n} c_i x_i$, where A is a

constant Hurwitz square matrix, b and c are constant n-dimensional vectors, x is the n-dimensional vector of generalized coordinates of the system, and the scalar function of the two variables σ and t, $\phi(\sigma,t)$, satisfies the condition $0 \leq \phi(\sigma,t)\sigma \leq k\sigma^2$. Because of its limited scope, the survey considers only studies on the absolute stability of continuous nonstationary automatic control systems. The survey is divided into three major sections, the first of which is devoted to linear nonstationary systems, the second to results obtained for nonlinear systems of the type described above, and the third to studies in which the problem of absolute stability is solved for certain other kinds of automatic control systems. In the section dealing with linear nonstationary systems of the type $\dot{x} = A(t)x$ it is assumed that nonstationary functions included in the system belong to a certain functional class and major attention is devoted to variation methods widely developed in recent year Discussed in detail are the application to the study of linear systems of Lyapunov's function and the frequency method, the utilization of the variation problem concerning the maximum deviation at a fixed moment of time, and the utilization of the variation problem concerning the maximum deviation at an unfixed time. Nonlinear nonstationary systems of the type described above are discussed in terms of their reduction to linear systems, of the application to nonlinear systems of Lyapunov's function and the frequency approach, and of the principle of a lack of finite solutions. Studies devoted to investigating the absolute stability of other kinds of automatic control systems, such as nonlinear controlled systems with delay, include V. A. Yakubovich's abstract approach and S. V. Shil'man's method of function derivatives. The necessary and sufficient conditions for the absolute stability of systems of the type described initially above found up to the present time extend only to systems of the second or third orders or are valid for systems of an arbitrary order of magnitude but have been formulated in a form insufficiently convenient for practical utilization. The need for further study is stressed. References 107: 67 Russian, 40 Western.

USSR UDC 62-501.47

SYNTHESIS OF CONTROL OF A MARKOV PROCESS WITH A RANDOM STRUCTURE

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 8, Aug 79 pp 49-58
manuscript received 27 Sep 78

BUKHALEV, V. A., Moscow

[Abstract] The results of an earlier study by the author on optimal filtering in systems with a random discontinuous structure are used here for the purpose of solving the problem of optimal control of a linear dynamic system which has a random discontinuous structure and is under the influence of additive and parametric random perturbations. The change in the structure of the dyr mic system considered is described by a Markov chain. In each of the states of the system's structure the system is described by linear stochastic differential equations containing additive and multiplicative white noise. Instead of utilizing the principle of duality, whereby the results obtained in designing a filter in the earlier study could be converted into corresponding equations for a regulator, the stochastic principle of a maximum, described in earlier studies, is applied to find a solution in a form convenient for engineering practice. This procedure defines the structure of a control system as the series connection of a filter and regulator in a direct feedback circuit. Optimal control is sought which will minimize the root-mean-square quality test and depend in a determinate manner on the results of observing a linear function of phase coordinates and noise. A system of equations is obtained which approximately defines optimal control as a nonlinear operator of the observation vector. A structural representation derived from the equations obtained is shown of an approximately optimal nonlinear control system. As an example, the following problem is solved: There exists a controlled process of the first order with uncorrelated parametric and additive noise. The process's output signal is observed in an additive mixture with noise. There are random interruptions in the arrival of information on the useful signal. Equations are given for the controlled dynamic system and the observation scalar. It is necessary to find the optimal control law minimizing the quality test. Figures 1; references: 7 Russian.

USSR UDC 62-501.72

ASPECTS OF THE APPLICATION OF THE METHOD OF LEAST SQUARES TO ESTIMATING LINEAR DIFFERENCE OPERATORS IN PROBLEMS OF IDENTIFYING CONTROLLED SYSTEMS

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 8, Aug 79 pp 86-92 manuscript received 21 Jul 78

ZHDANOV, A. I., and KOTSYUBA, O. A., Kuybyshev

[Abstract] A new method is presented for the identification of stationary linear dynamic systems for stochastic difference models of these systems in association with the utilization of digital computers for solving control problems. In assigning as the a priori model a linear difference equation of an assigned order of magnitude, the identification problem, because of additive noise in the system's output signal, becomes a problem of regression analysis entailing errors in independent input variables. The various methods used for solving this problem differ in the amount and character of the a priori information, the quality of the estimates obtained and the complexity of the computing procedure. The new method proposed here utilizes the same a priori information as in the method of least squares, with regard to the signals observed and the external noise, and also makes it possible to arrive at consistent estimates. This method makes it possible to arrive at consistent estimates, in terms of the criterion of the minimum root-mean-square error, of the parameters of difference equations of stationary linear dynamic systems from sample realizations of observed signals from the system. A stochastic difference equation is given, describing a stationary linear dynamic system. A theorem is then formulated, making it possible to determine the parameters of the two difference operators in this equation on the condition of minimization of the mean value of an expression used in solving the estimation problem. Asymptotic estimates are made of the parameters of linear difference equations minimizing the root-mean-square error. Parameters are estimated in terms of finite samples of observed signals realized. A calculation example is given. It is shown that the results of estimates by the method of least squares depend heavily on the noise level. The results obtained here show that the method suggested is invariant in relation to the additive noise in the output signal and does not require any more a priori information than the method of least squares. References 8: 6 Russian, 2 Western.

USSR UDC 62-504:681.326.74

INDICES OF DIAGNOSIS SYSTEMS

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 7, Jul 79, pp 137-145
manuscript received 14 Aug 78

ZHUKOV, M. V., KARIBSKIY, V. V.

[Abstract] This work presents the principles for caluclation of indices in a group consisting of lists of defects to be tested, a statement comfortable for diagnostic system designers, on the basis of indices from another list, the requirements for effectiveness which arise in the process of planning of an object, many of which cannot be achieved without diagnosis and repair procedures. The resultant list of indicators can be used both to plan diagnosis systems and to compare different versions of diagnostic systems for complex hardware systems. This article does not consider the reliability of the diagnostic system itself. Figures 2; references: 4 Russian.
[284-6508]

USSR UDC 62-506

DYNAMICS OF NONSEARCHING SELF-ADJUSTING SYSTEMS WITH MONITORING OF DYNAMIC CHARACTERISTICS ON THE BASIS OF SLIDING ESTIMATES OF THE STATISTICAL CHARACTERISTICS OF SIGNALS

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 5, Aug 79 pp 93-104
manuscript received 17 Oct 78

NACHINKINA, G. N. and SHNAYDMAN, M. A., Moscow

[Abstract] A study is made of the dynamics of nonsearching self-adjusting systems (BSNS's) with statistical pickups of dynamic characteristics (SIDKh's), with particular emphasis on an analysis of the dynamics of the self-adjusting circuit (KSN) and on selection of its parameters from stipulations for the required quality of self-adjusting processes. The structure of a BSNS includes the main circuit (OK), consisting of a nonstationary controlled system and a control unit with adjustable parameters, and a self-adjusting circuit, the KSN. Acting on the system, in addition to control signals, are noise and perturbations. The purpose of the KSN is to maintain the dynamic characteristics of the OK equal to the dynamic characteristics of a certain desirable model, usually in the form of a linear system with constant parameters having transient processes of an assigned quality. The dynamic characteristics of the OK are regularly measured in

the KSN and this information is then compared with known values for the desirable model and the mismatch is brought to zero by the formation of signals which readjust the parameters of the control unit. The dynamic characteristics of the OK are determined by measuring input and output signals and statistical methods of measuring are used to eliminate the influence of noise and any other random perturbations in the OK. A distinctive feature of the BSNS's with SIDKh's studied here is the fact that the KSN in them is implemented as a pulse-amplitude-modulation pulsed regulation system. Dynamic characteristics are determined on the basis of sliding estimates of the statistical characteristics of input and output signals. Equations are written for elements of the KSN, including for the self-adjustment system, the measuring unit, the comparison unit, the shaper and the actuator, for the purpose of describing their motion. Discussed also are the stability of the KSN, processes in the KSN and the determination of KSN parameters. The quality of self-adjustment processes is determined by accuracy in the steady-state mode, minimum length of the transient process and the permissible over-regulation. From an analysis of self-adjustment processes and modeling results it is concluded that the representation of a KSN as a linear pulsed system is totally legitimate and can be regarded as a first approximation. Application of the proportional integral law makes it possible to achieve self-adjustment processes of sufficiently high quality. Modeling can be employed to achieve a more precise representation of self-adjustment processes by taking nonlinearity of the KSN into account. As an example are given the results of investigations made by means of a digital computer of processes in a KSN for a very simple BSNS with a single self-adjustment parameter as applied to the banking channel of a pilotless aircraft. Figures 6; references: 8 Russian.

USSR UDC 621.313.392

CONTACTLESS LOGIC UNITS

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 7, 1979 pp 21-22

KULIKOV, B. P., engineer

[Abstract] A system of standardized contactless units has been developed, consisting of units for interconnection of contactless and contact-type terminal switches, signaling units, units for operation of molding automata and automatic production lines, time delay units, logic units and units for connection of actuating drives. The system is based on transistorized "Logika-T" logic elements. All units are mounted in standard cases measuring 100 X 220 X 465 mm. Test sockets are provided for automatic diagnosis in all units. A diagram is presented of a control system using the standardized units. Figures 1.
[283-6508]

USSR UDC 621.382

DESCRIPTION OF TOPOLOGICAL DRAWINGS OF LARGE-SCALE-INTEGRATION CIRCUITS

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 1, Jan-Feb 79 pp 61-65 manuscript received 16 Jun 77; after completion, 1 Jun 78

RUBTSOV, VALERIY PAVLOVICH, candidate in technical sciences, Kiev

[Abstract] The high complexity of LSI circuits is most cumbersome at the lowest level of description, namely in the topological drawings produced by photolithography. It is quantitatively defined by the number of nodal points, the number of technological layers, and the number of different circuit elements. Here, with regard to automation of the design process, both the external description of the design object in terms of hardware and the internal description of its mathematical model in terms of software are considered The total description of topological drawings must account for the hierarchical structure and aim at standardization, "computability" of algorithms used in lieu of explicit descriptions, and regularity. A language of external description such as the Unified System of Design Documentation (ESKD) language can, accordingly, be represented as a simple product of four sets of means for describing respectively: a hierarchical structure, individual topological elements, periodic segments, and the diversity of circuit configurations. The internal description is based on matrix models, with the external description assumed to be explicit up to the coordinates level, for drawings in quadrant or even octant configurations. There is a tradeoff between a hierarchical mod-l and a matrix model of a topological drawing, the latter being simpler with respect to data processing and the former being simpler in terms of data storage. Figures 1; tables 1; references: 8 Russian.
[10-2415]

USSR UDC 581.3

HOOKUP OF A VT-340 DISPLAY IN THE CAPACITY OF AN OPERATOR'S PANEL TO AN 'ELEKTRONIKA-100/16I' COMPUTER

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 4, Jul-Aug 79 pp 118-121 manuscript received 12 May 78

KONOV, N. N., State Planning Design and Experimental Institute of Coal Handling Machinery, Moscow

[Abstract] The data input-output system for an "Elektronika-100/16I" computer has been modified by adding to the "Konsul-260" electric typewriter

the general-purpose VT-340 alphanumeric display, the latter being more reliable in operation because of the absence of moving components. The system includes a VT-14 parallel interface for data exchange in an 8-digit parallel code and also controls for data input from the keyboard as well as for data output on the screen. Hookup is effected through standard computer modules and an extra RPPM18-288 socket. It is important during installation to disconnect certain circuits while keeping others properly connected. Figures 2; references: 2 Russian.
[18-2415]

USSR UDC 681.3:62-181.4:62-52

EMPLOYMENT OF MICROCOMPUTERS IN AUTOMATIC MONITORING AND CONTROL SYSTEMS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 5, 1979 pp 9-10

TIKHONOV, V. S., general director, Lenteplopribor [Leningrad State Plant for Electronic Heat Control Instruments] NPO [Scientific Production Association]; GIL'MAN, G. I., and AL'TSHUL', S. D., candidates in technical sciences

[Abstract] As an example of a microprocessor unit for constructing centralized monitoring units the basic model A330-25 is described, developed at the Lenteplopribor NPO and employing as a central control unit an "Elektronika S5-02" microcomputer. In combination with standard units of the ASKR [automated system for monitoring and control] complex the A330-25 makes it possible to collect, measure, process and represent as many as 64 unified analog and 40 binary signals. It features a programmed sequence for interrogating input parameters and its modules for commutating binary signals have built-in hardware for initiative commutation, meaning that interrupt commands are issued to the microcomputer only if any one binary signal changes its state from zero to one or from one to zero. In coding analog signals a periodic check is made of the measuring channel by supplying reference signals and by introducing the appropriate correction in the microcomputer when required. The microcomputer is connected to the unit's common line by means of input and output interface modules, which make it possible to connect directly to the unit a number of peripherals, such as a type BA11-005 alphanumeric recorder, a teletype, a PL-150 keypunch machine, an FS-1501 photoelectric reader and a "Kvant" video monitor. The unit employs a semipermanent memory with electrical rerecording of signals for the purpose of storing only processing programs and constant factors. This is necessitated by the fact that the microcomputer's direct-access storage is not protected from voltage drops in the line and that for the purpose of making changes in the permanent memory it is necessary to make a new large-scale integrated circuit since the program is entered in the permanent memory by means of masking the large-scale integrated circuit

at the stage of its fabrication. The semipermanent memory is connected to the microcomputer's main internal line and makes up a unified memory area for the microcomputer together with the permanent memory and direct-access memory with ripple-through addressing. The capacity of the semipermanent memory is 2K 16-bit words and the access time is 3 μs. The "Elektronika S5-02" microcomputer performs 10,000 short operations per second, has a programmable timer, has a three-level interrupt system, has a maximum power requirement of 100 V·A and overall dimensions of 460 X 415 X 245 mm. The capacity of its permanent memory is 4K words and of its working storage 6 K words. The A330-25 microprocessor unit includes an operator's console which makes it possible to communicate with the microcomputer by entering and reading out information in the decimal system, as well as to assign 16 different information processing modes. The flexibility of the A330-25 has made it possible to develop on its basis other units for monitoring and controlling various processes. A description is given of two of these, the A329-24 for group automated processing of chromatograms, and the A360-34, a program coordinate-time unit for automating submerged arc remelting processes. In the A329-24 the A330-25 is supplemented with external multirange units for converting the signals of chromatograph detectors into a unified 0 to 10 V signal, with the microcomputer automatically selecting the required measurement range. The A329-24 unit determines the area of a peak and the period of emergence of its tip, rectifies the misreading of completely separated peaks, corrects drifting of the base line, and di[illegible]s the concentration of components. The A360-34 is given as an example of realization of the objectives of centralized monitoring of technological units and of controlling them on the basis of a microprocessor unit. In units of this type the microprocessor must perform the functions of directly influencing the controlled process by forming and issuing to actuators analog and digital control signals. These examples demonstrate that it is possible to create on the basis of microprocessors a number of units for monitoring technological units and for controlling them, as well as for processing measuring information, including for analytical instruments. The importance is stressed of the need to develop a number of integrated hybrid analog input-output devices (adapters) which will include all the required hardware, such as multiplexers and measuring amplifiers, and operating with microcomputers as does an ordinary memory cell. The solution of this problem and others will make it possible to create automatic monitoring and control equipment not inferior to the best foreign models. Figures 3; references: 3 Russian.

USSR UDC 681.3.621.317.002

ONE METHOD OF SELECTING A MICROPROCESSOR FOR INCORPORATION INTO A RADIOMETRY SYSTEM

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 2, Mar-Apr 79 pp 70-72 manuscript received 24 May 78; after completion, 5 Oct 78

KONDALEV, ANDREY IVANOVICH, doctor in technical sciences, Institute of Cybernetics, Ukrainian SSR Academy of Sciences, Kiev: DENISENKO, VYACHESLAV PLATONOVICH, candidate in technical sciences, Kiev; and KOZACHKOVSKIY, ALEKSANDR DMITRIYEVICH, engineer, Kiev

[Abstract] The functional versatility of radiometry system can be broadened by incorporation into them of microprocessors. Here a microprocessor for this purpose is selected, from the various available types, on the basis of efficiency criteria. Accordingly, the microprocessor characteristics are considered which determine the microprocessor compatibility with a radiometry system and the overall efficiency of the combination. The microprocessor characteristics significant in this respect are technological ones including speed and cost, structural ones pertaining to the microprocessor components, architectural ones including modularity and standardization as well as hookup facilities, and functional ones such as speed, energy consumption and the number of nominal voltages suitable for operation. An analysis and numerical estimates on the basis of these criteria indicate, for illustration, that an SBP-0400 microprocessor is preferable to an Intel-8080 microprocessor for operation with an S1-75 oscillograph. References 3: 2 Russian, 1 Western.
[13-2415]

USSR UDC 681.32:65.012.1.122

ANALYSIS OF ALGORITHMS FOR INTERFACING LARGE AND SMALL COMPUTERS IN REMOTE PROCESSING QUEUEING SYSTEMS. II

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 7, Jul 79 pp 156-165 manuscript received 19 Jun 78

VISHNEVSKIY, V. M., ZHARKIKH, V. A., ZHOZHIKASHVILI, V. A., PETUKHOVA, N.V.

[Abstract] A study is made of a single-line queueing system with waiting, the input of which receives a simple flow of requests with intensity > 0. The requests are served in two stages: recording and servicing itself. Two queueing disciplines are studied: 1) recording of incoming requests each time servicing of a request is completed; and 2) recording of incoming

requests at predetermined time intervals. Equations are derived for line length and waiting time for both disciplines. The mean characteristics of the system are calculated. Figures 1; references 6: 5 Russian, 1 Western.
[284-6508]

USSR UDC 681.327.8

THE TsIP A611-15 INTERCONNECTOR IN THE M-6000-M-7000 SYSTEM

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 7, Jul 79 pp 10-11

DERKACH, V. N., KAPUSTNIKOV, V. I., MISHCHENKO, D. A. and RUSS, YE. M., engineers

[Abstract] To automate processes of measuring or monitoring the parameters of components in the ASVT-M modular system of computer facilities based on microelectronic circuits, the authors consider the approach of connecting digital measuring instruments to the M-6000-M-7000 system. As a result, the TsIP A611-15 interconnector is developed for programmed control of the measurement process with automated input of data from the measuring instruments to the processor. The interconnector contains an interface module, and a connecting line that is 10 meters long. The interconnector is made in different modifications depending on the input signal levels. The unit triggers the digital measuring instruments from the processor, and inputs data from the instruments to the processor through as many as 32 information lines. The logical "1" for the input data can take any of eight voltage levels. The working principle of the interconnector is explained and a flowchart is given together with a block diagram of the module. Figures 3; references: 4 Russian.
[6610-277]

USSR UDC 681.327.64

ORGANIZATION OF BULK STORAGE WITH SEQUENTIAL ACCESS IN SM COMPUTERS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 5, 1979 pp 11-12

KOVBAS, V. V., KULIK, A. I. and OZHIGANOV, YU. M., engineers

[Abstract] A detailed description is given of the structure and functioning of magnetic tape storage units used in SM series computers. The unit

consists of the magnetic tape storage controller and the tape storage itself. In all SM computer magnetic tape storage units nine-track magnetic tape is used, measuring 12.7 mm in width and 750 or 375 m in length depending on the type of standard reel used in the specific storage unit model. In magnetic tape storage units of phase one of SM computers is employed the method of recording without returning to zero (the BVN-1 method) and data are recorded with a density of 32 and 8 bits/mm. The storage unit controller for the SM-3 or SM-4 control computer complex makes possible the operation of as many as any 4 storage units of phase-one SM computers and 2 storage unit models can be hooked up simultaneously with tape speeds of 0.5, 0.75, 1, 1.5 and 2 m/s or 12.5, 25, 37.5, 45 and 75 inches/s. Program control of the controller is accomplished entirely by means of six controller registers: a command register, a state register, a byte counter, a current memory address register, a data buffer register and a unit read line. These registers have been assigned addresses similar to the addresses of the working storage. The functions and operation of these registers are discussed in detail. On a single line of magnetic tape are entered eight bits of information and one control bit. Bytes are recorded perpendicularly to the length of the tape. Information is entered on the tape in zones separated by gaps representing sections of tape without recording. The nominal length of a gap between zones is 15.2 mm. Data are entered and read in zones of arbitrary length of not less than 18 bytes. The maximum recommended length of a zone is not greater than 2048 bytes for the purpose of guaranteeing interchanging. Zone groups are separated by means of a zone group marker in the form of a two-byte zone consisting of a zone group marker line and a lengthwise control line containing bits recorded on the second, third and eighth tracks. The tape stop marker is placed at a distance of 4.6 m from the physical beginning of the tape and the tape end marker is placed at a distance of 7.6 m from the physical end of the tape. Three types of control (vertical, lengthwise and cyclic) are provided in the controller for determining the correctness of the information entered and read out. Vertical control is exercised by entering on the parity track, when recording a zone, a control bit with a value so that the number of bits in the line with a value of one must be odd. An error is recorded if any byte contains an even number of ones. In lengthwise control a lengthwise control line is entered at the end of each zone and the sum of the values of the bits of this line on each track must be even. Cyclic control consists in the fact that in the process of recording a zone a cyclic control line is computed by means of a cyclic code in the controller and this line is recorded after the last byte of data and before the lengthwise control line. When the "playback" command is fulfilled the cyclic control line is again computed and compared with that recorded on the tape. Cyclic control is not employed in operation with a recording density of 8 bits/mm. How the magnetic tape bulk storage unit reacts to the controller's commands is explained in exhaustive detail. These commands include "record," "start," "record at extended interval," "enter zone group marker," "playback," "advance to zone," "return to zone," "rewind" and "transfer to local control."

USSR UDC: 681.327.68:621.325.66

INTEGRATED PHOTO MATRIX INTERFACE WITH SYSTEM FOR READING OF PAGES OF INFORMATION IN AN OPTICAL MEMORY

Novosibirsk AVTOMETRIYA in Russian No 3, May/Jun 79 pp 74-78 manuscript received 1 Dec 78

BUTT, V. YE., PANKOV, B. N., Novosibirsk

[Abstract] Pages of information are read from optical memories by means of photo matrices, multiple-element photoelectric devices which convert reduced optical images of pages of information to their electrical analogues-digital codes. Interfacing of MOS photo matrices with reading systems, generally consisting of TTL circuits, requires the use of special interface devices. Some of the interface devices and their connections are described, and requirements for interface devices are analyzed. Schematic diagrams of comparators, signal shapers and other simple devices are presented. Figures 3; references: 3 Russian.
[2-6508]

USSR UDC: 681.327.68:778.38:621.383.181.48:681.3.019

MULTIPLE-ELEMENT PHOTODETECTOR MATRICES FOR HOLOGRAM MEMORY AND COMPUTER DEVICES

Novosibirsk AVTOMETRIYA in Russian No 3, May/Jun 79 pp 20-39 manuscript received 9 Nov 78

MATIYENKO, B. G., NESTERIKHIN, YU. YE., Novosibirsk

[Abstract] A discussion is presented of a number of results achieved at the Institute of Automation and Electrometry, Siberian Branch, USSR Academy of Sciences, in the development and study of the characteristics of a series of experimental photoelectric instruments for holographic memories manufactured using MOS technology. The current situation in the area of techniques and technologies of memory units is discussed and new trends in research related to the development of photoelectric devices for multichannel (parallel) processing of digital optical information are discussed. The program of research in multiple-element "light-to-code" convertors are presented. Developments in the US and Japan are particularly noted. New research trends are mentioned, and the possibility of creating of photo matrix processors, allowing read/write and multichannel logic-arithmatic processing of entire pages of digital optical information is studied. Figures 9; references 71: 43 Russian, 28 Western.
[2-6508]

USSR UDC 681.335.4

ONE METHOD OF IMPROVING THE FUNCTIONAL RELIABILITY OF DIGITAL COMPUTERS

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 1, Jan-Feb 79 pp 53-57 manuscript received 12 May 77; after completion, 3 Feb 78

ALIPOV, NIKOLAY VASIL'YEVICH, candidate in technical sciences, Kharkov Institute of Radiophysics and Electronics

[Abstract] Since checking digital computers for intermittent $1 \rightarrow 0$ and "short circuit" failures by methods based on Fibonacci codes is ineffective, with a nonbinary arithmetic further complicating the procedure, a method is proposed which utilizes algorithms of analog-to-digital conversion insensitive to pulse interference. These algorithms are constructed, assuming the number of steps and the maximum duration of random pulses as well as the initial zone of ambiguity for a constant signal and the number of simultaneously performed experiments to be known. These algorithms are based on the 1_1-representation of numbers, specifically with $1_1 = 1_2 = 1$, which will reveal faulty computer components under certain constraints in the case of intermittent $0 \rightarrow 1$ as well as $1 \rightarrow 0$ and "open circuit" as well as "short circuit" failures. These are algorithms of checking the 1_1-representation, comparing it with others, and converting it to a binary code, also addition with the carry extended to higher or lower positions and generation of a backward code. The 1_1-representation requires a much larger memory and lowers the speed of the discretizer, therefore is worthwhile only in special-purpose systems with a high interference level. Tables 7; references: 5 Russian.
[10-2415]

USSR

A NONDIVERGENCE ALGORITHM FOR FILTRATION

Moscow TEKHNICHESKAYA KIBERNETIKA in Russian No 4, Jul-Aug 79 pp 168-170 manuscript received 22 Dec 77

SALYCHEV, O. S., Moscow

[Abstract] In optimal linear filtration according to Kalman the state of an object under deterministic and random perturbations is estimated from noisy measurements. Here the problem of divergence is considered, its main causes being inaccurate mathematical description of the object and statistical description of the random perturbations as well as calculation errors. One known procedure for preventing divergence involves artificial

"weighing" of the covariational a priori matrix of estimation errors. An adaptive algorithm is now proposed which includes selection of a variable multiplier, to ensure maximum probability density of the innovation sequence. Unlike the conventional and somewhat deficient Kalman filtration algorithm, where the optimum gain matrix is calculated from a priori data only, this algorithm uses also a posteriori data based on measurements and thus provides a necessary correction. Implementation of this algorithm requires only addition of one scalar equation for the multiplier to the main algorithm. A drawback is that all components of the estimation error matrix must be identically weighed, but this difficulty can be overcome by sequential filtration on the basis of scalar measurements so that individual multipliers can be assigned to each measurable matrix component. Figures 1; references: 4 Western.
[11-2415]

USSR UDC 621.391.822.3:621.397.13

MEASUREMENT OF NOISE ON THE BASIS OF THE SIGNAL FROM A MOVING TELEVISION IMAGE

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 7, Jul 79, pp 41-45

VILENCHIK, L. S., ZVEREV, YU. B. and TRET'YAK, S. A., State Scientific-Research Institute of Radio

[Abstract] The problem of measuring the signal-to-noise ratio in analog or digital television channels is considered. Such measurement is based on the statistical characteristics of a television signal appearing together with fluctuational interference, optimal linear filtration of this interference and prefiltration processing of the signal. This procedure makes it possible to measure noise during transmission, directly on the signal from the moving color image at the decoder output, separately in the brightness channel and in the color-differences channel. Figures 4; references 18: 17 Russian, 1 Western.
[286-2415]

USSR UDC 621.397.132

OUTLOOK FOR THE USE OF CHARGE-COUPLED DEVICES IN PROFESSIONAL COLOR-TV EQUIPMENT

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 7, Jul 79 pp 55-57

LUNEVA, Z. P. and NOVAKOVSKIY, S. V.

[Abstract] Charge-coupled silicon devices serve as the basis of novel color-to-signal converters, their sensitivity being determined by noise as well as by the efficiency of conversion of luminous energy to a potential distribution. Existing charge-coupled devices are already suitable for special-purpose color-TV equipment but not yet for color-TV broadcasting equipment. The latter application requires a better signal uniformity over the image field, possibly attainable by brightening which generates ambient charge and thus reduces the effect of signal charge entrapment at the semiconductor-dielectric interface, as well as by lowering the dark current by cooling. It also requires a better resolution and a higher sensitivity in the short-wave range of the spectrum. The latter problem involves selection of the semiconductor substrate. Another problem is image dispersion due to local illumination, which it should be possible to eliminate by means of a quenching pulse at the end of a frame. Further research on these devices is worthwhile, because of their advantages: small size and

mass, high mechanical strength, long life, and low power drain. A television camera with charge-coupled devices does not, furthermore, require organophosphor compounds, sweep generators and high-voltage sources. Small geometrical distortions and excellent manufacturability of these devices make retention of stable image compatibility feasible. However, cathode-ray tubes still produce images of a better overall quality than that of images produced by charge-coupled devices. Both types of devices will, therefore, continue to be used and improved on a competitive basis and, possibly, also in combination. References 11: 3 Russian, 2 German, 6 Western.
[286-2415]

USSR UDC 681.327.11(088.8)

A DEVICE FOR GENERATING SYMBOLS ON THE SCREEN OF A TELEVISION INDICATOR

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 4, Jul-Aug 79 pp 121-124 manuscript received 5 Apr 78

KIRPICHNIKOV, V. M. and KHOTEYEV, V. P.

[Abstract] A device has been developed for generating slanted alphanumeric symbols on the television screen, to improve visual perception and to reduce eye fatigue when information coming from more than one source appears on it. The device can operate with either a linewise or an interlacing sweep and resolution. It includes a line decoder, a symbol decoder, a delay circuit, a pulse signal distributor, a clock pulse generator and a clock pulse counter. Video intensifier pulses are synthesized through NOR logic, and the components are built on series 133 integrated microcircuits. Figures 3; references 3: 1 Russian, 2 Western.
[18-2415]

USSR

AUTOMATED MONITORING OF TV SIGNAL PARAMETERS

Moscow VESTNIK SVYAZI in Russian No 6, Jun 79 pp 24-25

BEL'SKIY, YE. A.; GOGOL', A. A.; LUKIN, M. I.; MISHNENKOV, I. B.; OTRIGIN, V. A. and CHERNYY, V. YA., coworkers of Leningrad Electrotechnical Institute of Communications imeni Bonch-Bruyevich

[Abstract] A basic parameter which must be measured in TV transmissions is the amplitude of the TV signal. According to GOST 19432-74, the studio

equipment channel must insert a white level reference pulse of 0.7 volts. A new device can measure this signal to within 0.3 to 0.5 percent accuracy. The signal passes through a variable locking circuit (USF) and a dynamic memory (DZU) tracks the input signal and can reproduce it later. An analog-digital converter (ATsP) converts voltage into pulses and an averaging and display unit (BUiI) averages the measured signals during 64 scans. Another important parameter which should be measured is video sharpness: this can be done by measuring the pulse front widths of the brightness signal drop. The brightness signal is usually part of the total color signal (PTsTS). The drive signal shaper (BFUS) shapes pulses which divide the active part of the field into vertical zones. Brightness signal drops are used in an oscillator to generate a pulse train whose front widths are equal to those of the corresponding drops. A low-pass filter has a band-pass of 0-3 MHz. It eliminates the colorsignal at the input of the second oscillator. Various filters and comparators are used in the device to monitor the level of the constant reference signal, brightness and background noise. Figures 4.
[237-8617]

USSR UDC 771.44:778.53.058.2

UNDERWATER MOTION PICTURE LIGHTING EQUIPMENT

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 7, Jul 79 pp 16-21

ZEMTSOVA, N. P., KURITSYN, A. M. and SEMENIKHIN, N. T., All-Union Scientific-Research Institute of Motion Picture Photography

[Abstract] New equipment for underwater lighting has been developed at the All-Union Scientific-Research Institute of Motion Picture Photography, jointly with the Kiev branch of the Odessa Design Bureau for Motion Picture Equipment. This includes two lamps with own power packs consisting of special-purpose nickel-cadmium cells: the single-bulb 12V-100W "Effekt-100" and the double-bulb 30V-300W "Skat-300", each bulb delivering a light intensity of 100,000 cd in a narrow beam in air. Three other lamps are energized from the 220V power line (PMGL and PLN-1), one of them through a 220/12V stepdown transformer. They all have paraboloid aluminum reflectors and they meet severe design requirements: compactness for most reliable hermetic sealing, corrosion-resistant case with a smooth profile for minimum hydraulic drag, and mechanical strength for withstanding the pressure at low depths. The bulbs are protected by glass domes. Automatic controls are provided, including shutdown in the case of leakage or undervoltage. The battery-powered lamps can operate for 50 min and 20 min respectively without recharging. The luminosity curves of all lamps under water have been calibrated with exposure meters according to standard procedure, at various angles and depths. Figures 8; tables 2; references: 3 Russian.
[286-2415]

USSR

SOUND REPRODUCTION SYSTEM: THE SPEAKER

Moscow RADIO in Russian No 7, Jul 79 pp 28-31

SALTYKOV, O. and SYRITSO, A., All-Union Scientific Research Institute of Cinematography

[Abstract] A method of controlling the degree of damping of the moving system in a speaker is described in which the output impedance of the low-frequency amplifier is varied. It is shown how the required amplitude-frequency response is synthesized in this case with respect to sound pressure. Requirements for an amplifier with negative output impedance are formulated, and a method is outlined for designing feedback circuits. Particular attention is given to reducing the amplitude of displacements of the moving system to cut down nonlinear and intermodulation distortions, and also to achieving a flat phase-frequency response for the separation filter with respect to the so-called overall output, i.e. with respect to the overall signal from the high-frequency and low-frequency outputs. A speaker is described that uses 10GD-30 and 3GD-31 heads from the popular 10MAS-1 speaker and a high-quality amplifier with negative output impedance constructed from widely accessible components. Frequency reproduction is in the range of 20-30,000 Hz, the nonuniformity of amplitude-frequency response is 6 dB with respect to acoustic pressure in the frequency band of 45-16,000 Hz, the power rating is 10 W, the average standard sound pressure is 0.13 N/m^2, impedance rating is 8 ohms, measurements are 460 x 350 x 260 mm, and mass is 12 kg. Figures 14, references 3: 2 Russian, 1 Western. [279-6610]

USSR

ARTIFICIAL EARTH SATELLITE ON-BOARD RETRANSMITTER SIGNAL SIMULATOR

Moscow VESTNIK SVYAZI in Russian No 6, Jun 79 pp 26-27

KUSHCH, A. B., chief, Altaysk Kray Radio and Television Transmission Center and YANYGIN, V. S., chief of the zone laboratory

[Abstract] Communications experts at the Altaysk Kray Radio and TV Transmission Center developed an artificial earth satellite (ISZ) on-board retransmitter signal simulator to monitor broadcast signals and improve TV maintenance of retransmitters and reduce time required for testing and repair. Type STV-1 TV retransmitters receive signals from artificial earth satellites and are generally situated a great distance from the base operating enterprises. Personnel waste a lot of time going out to test equipment when there is no signal coming in from the satellite. With the aid of a portable retransmitter signal simulator, this waste of time can be eliminated. The main part of the simulator consists of a two-cycle hf oscillator using GT329A transistors or the like. DM-0.6-10 type hf chokes are the aperiodic collector load for the transistors. The oscillator is not frequency-stabilized, which simplifies its design and tuning. Working frequency is controlled by a potentiometer until a sharp image is received on the CRT monitor. The simulator is small: 100 x 66 x 30 millimeters and weighs 225 grams. The multivibrator and hf oscillator are mounted on a common two-sided PCB which holds all the components. The "Krona-VTs" battery serves as a power pack. Figures 2.
[237-8617]

USSR

NEW AUTOMATIC TELEPHONE STATION IN CHERNOVTSY

Kiev PRAVDA UKRAINY in Russian 11 Sep 79 p 3

[Article: The Means of Communications Are Being Improved"]

[Text] An automatic telephone station for 6,000 subscribers has been put into operation in Chernovtsy. The modern equipment of the so-called crossbar type that has been installed here provides more stable and improved quality communications.

Installation of the new station has expanded the telephone network of the oblast center by approximately 30 per cent. Altogether since the beginning of the five-year plan stations with a total capacity of nearly 500,000 subscribers (telephone numbers) have been put into operation in the republic's cities.

"Before the end of the year automatic telephone stations of the crossbar type will be put into operation in Kiev, Voroshilovgrad, Donetsk, Yevpatoriya and other cities," reported the deputy ministry of the UkSSR Ministry of Communications, I. Ye. Timcheko, to a correspondent of the RATAU (Radio and Telegraph Agency of the Ukraine SSR). "The switch over to the crossbar type stations has increased the percentage of automation of the city telephone network in the republic to 99.8 percent."

The long-range plan calls for the further adoption of automatic equipment, which provides a high throughput capacity for the equipment and lines.

Thus, next year it is planned to connect in Kiev the first automatic telephone station in the republic that has electronic equipment. This will provide the residents of the city with several additional services: the automatic re-addressing of telephones, a reduction in the amount of numbers one must use in dialing and simultaneous conversation with several subscribers on one telephone.

In accordance with the decisions of the 25th Party Congress the creation of the National Unified Automated Communications Network (YeASSS) is continuing; an important part of this system is the city telephone and telegraph communications of our republic. This year it was planned to lay 953 kilometers of cable lines; however, the communications workers have reexamined their pledges and have decided to do an additional 270 kilometers of communications work and by USSR Constitution Day to complete the annual plan for growth in long distance telephone channels.

The expansion of the network of postal enterprises is continuing.

USSR

SWITCHBOARD FOR WIDE-BAND SIGNALS

Tbilisi ZARYA VOSTOKA in Russian 16 Sep 79 p 4

[Article by D. Ivanishvili: "Plans and Achievements: A Multi-Purpose Switchboard"]

[Text] A new communications system, a wide-band signal switchboard, has been created in the department of automatic electric communications of the Georgian Polytechnical Institute imeni V. I. Lenin in accordance with an assignment from the Central Scientific-Research Institute of Communications in Moscow.

The chairman of the department of electric communications at the Georgian Polytechnical Institute, senior lecturer T. Kupatadze, is showing us a small box with numerous boxes and matrices. Within them is enclosed the brain of the system, which is capable of automatically performing the necessary switchings that correspond to the signal. The wide-band switchboard, which is installed in an automatic telephone station (ATS), performs the function of a multi-purpose station that provides in addition to regular telephone communications various other kinds of communications. With its help one can organize video communications with any subscriber who has a video apparatus. In the opinion of specialists, the ability to switch channels of communications for electronic computers is very promising. Moreover, according to preliminary estimates, the amount of information that can be processed on a computer is increased several times. New memory storage registers, which are being created by scientists for the switchboard, will make it possible to expand its application even more: in the future it will be used to switch long distance and television signals.

The innovation has no sooner left the laboratory than it has become an object for the exposures of documentary film makers and enthusiasts. The film created by the students of the faculty of public professions of the Polytechnical Institute recounts the capabilities of the new device.

The light goes out and on the screen appears one of the Georgian republic's largest enterprises. The plant director turns on a video apparatus that is installed in his office. To do this one needs only to dial the telephone number of the appropriate shop to be able to observe the production work, to make emergency meetings and to make "corrections" to the blueprints of a future manufactured article and give orders. Another group of documentary film makers takes us into the reception office of a maternity home. A young man who has just become a father dials the telephone number of the ward where the newly born child is. In a minute the eye of the video apparatus "introduces" the father to his child.

The film acquaints us with one other important "profession" of the switchboard. It turns out that the switchboard will find successful application

in a school for the deaf and dumb: the screen of the video apparatus will help the teacher "speak" to his wards.

The authors of the film discuss with plant and factory managers, health care specialists who have felt a sharp need for such a multi-purpose means of communications.

The creation of the wide-band signal switchboard was preceded by many years of searching by the Georgian scientists. At the first All-Union Symposium on Problems of Videotelephone Communications, which was held in Tbilisi several years ago, a model of an automatic videotelephone communications system was displayed. The model was approved by scientists and leading Soviet specialists.

Soon the new communications system will be subjected to serious testing at one of the largest industrial enterprises in the Soviet Union. Then it will be put into series production.

USSR UDC 51.330.115

OPTIMIZATION OF THE PRODUCTION AND FINANCING ACTIVITY OF THE PRODUCTION AND TECHNICAL COMMUNICATIONS ADMINISTRATION (PTUS)

Moscow ELEKTROSVYAZ' in Russian No 7, Jul 79 pp 24-26 manuscript received 11 Jul 78

MOKROV, V. M.

[Abstract] This article represents the first attempt at development of an imitation mathematical model of the production and financial activity of a communications operation at the level of the Production-Technical Communications Administration (PTUS). To improve reliability, the model considers the effect of random factors. A numerical example is included. Running of the mathematical model on a computer allows prediction of the values of the primary technical and economic indices of the activity of the Administration. The model is a statistical model, with parameters adjusted to the operation of a particular communications administration, but can be used at all levels of administration, from the individual enterprise through the Communications Ministry. Tables 2; references: 2 Russian.
[274-6508]

USSR UDC: 534.6:534.83

VIBRATION-ABSORPTIVE COATING TO REDUCE NOISE AND VIBRATION OF TELEGRAPH APPARATUS

Moscow ELEKTROSVYAZ' in Russian No 7, Jul 79, pp 21-23 manuscript received 28 Feb 77

KUKIN, YU. V., MOLODAYA, N. T., PALEY, M. I., PAPERNOV, L. Z., REZNICHENKO, L. A., SUZDALEV, S. I. and TREPELKOVA, L. I.

[Abstract] Measurementsof vibration levels on the walls of the sound-absorptive covers of telegraph apparatus has shown that the vibration which penetrates the covers is primarily low and middle frequency vibration. Vibration-adsorptive coatings can be used to decrease this vibration still further. Studies were performed on the STA-F67 telegraph apparatus in an anechoic chamber. The noise and vibration were measured before and after application of "antivibrit-1," "antivibrit-5", VM-1, SVM-90 and SKL-25 coatings. Significant reductions can be achieved only by a combination of coating and redesign of the sound-absorbing covers. Figures 2; tables 1; references: 6 Russian.
[274-6508]

USSR UDC 62-50

USING AN INTERFERENCE CLASSIFIER IN DETECTION SYSTEMS FOR SIGNALS SUBMERGED IN BACKGROUND NOISE

Kiev AVTOMATIKA in Russian No 1, Jan-Feb 79 pp 11-16 manuscript received 10 Jul 78

ZIL'BERSHTEYN, A. M. and NATKOVICH, YU. S., All-Union Scientific Research Institute of Metrology imeni D. I. Mendeleyev, Tbilisi branch

[Abstract] A mixture of signal and interference is considered, but with the latter alone appearing during some initial processing period. In this case the detection problem can be formulated as one of testing composite statistical hypotheses, optimal decision rules for which are rather difficult to realize. Suboptimal decision rules with the use of a classifier are, therefore, examined instead in the case of complete a priori information as well as in the case of ambiguity with respect to signal and "pure" interference probabilities. Two theorems are proved on the basis of which the penalty and the payoff of using such suboptimal decision rules can be estimated. References: 2 Russian.
[3-2415]

USSR UDC 621.3.019.3:621.396.44

INTERPOLATION METHOD OF ESTIMATING RELIABILITY CHARACTERISTICS OF RETRANSMISSION NETWORKS WITH A HOMOGENEOUS STRUCTURE

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 8, Aug 79 pp 172-179
manuscript received 2 Oct 78

GADASIN, V. A., Moscow

[Abstract] A communications retransmission network is represented in the form of a graph in which apexes represent stations and the edges or arcs of the graph represent communications channels. The problem of finding the reliability characteristics of a communications network reduces to the problem of finding the probability characteristics of the existence of pathways or links between the apexes of an appropriate random graph. Prevalent among possible structures of communications retransmission networks are uniform cell configurations, typical of which is a lattice configuration, which can be represented by a graph in the form of a lattice with cells in the form of polygons. In the case of a graph with square cells for an estimate of the probability of good connections it is possible to use the characteristics of graphs obtained from the original graph by collapsing the apexes of individual horizontal rows into a single apex. The resulting radial ring graph simplifies the problem of finding the probability of good connections. Although this method is effective only for an ordered, or recurrent, graph, it has made it possible to suggest the existence of a more general method useful in analyzing other kinds of arbitrary graphs. A description of such a method is given here, which generally speaking can be used for analyzing any random graph but is most effective when used to study distributed cell structures with highly reliable elements. The use of this method makes it possible relatively simply to estimate various reliability characteristics, such as the probability of the existence of a link between specific communications stations, the probability of failure-free operation, the mean number of stations linked to a specific station, and the power distribution of a component of a specific station. The method is similar to the method of interpolation where in interpolating function $f(x)$ another function is plotted which coincides with the original at a fixed number of points. In this case a multidimensional function is estimated, $\Phi = \Phi(q_1, q_2, \ldots, q_n, \sigma)$, which is the probability characteristic of a random graph as a function of failure parameters σ, q_i, $i = \overline{1,n}$, of groups of its elements. As an estimate of the k-th order for function, Φ is plotted another function, R_k, coinciding with Φ at fixed subsets of points. The major features of the method are determined by the type of function and the choice of subsets mentioned. For example, computations are simplified drastically if the probabilities of failure of the graph's elements equal zero or one. The estimate of R_k coincides with $\Phi(q_1, q_2, \ldots, q_n, \sigma)$ if at least $(n-k)$ groups of variables q_i equal zero. The characteristic sought depends on the $(n+1)$-th subset of variables in the form of the probability of failure of the network's elements. The estimate

agrees with the characteristic if any (k + 1) subsets of variables differ from zero. The method's concept is substantiated theoretically. The general statements are given specific applications in finding the probability characteristics of good connections in random graphs. The capabilities of the method are illustrated in several examples. It is suggested that this method will become widespread in similar studies of the characteristics of random graphs used in the theory of finite automata and in the study of Markov chains. Figures 3; references 4: 2 Russian, 2 Western.

USSR UDC 621.372.44

STATISTICAL CHARACTERISTICS OF THE RATIO OF MIXTURES OF A GAUSSIAN PROCESS WITH A PROCESS THAT HAS NON-GAUSSIAN DISTRIBUTION

Kiev IZV.VUZ: RADIOELEKTRONIKA in Russian Vol 22, No 7, Jul 79 pp 52-56 manuscript received 3 May 78

MELITITSKIY, V. A.

[Abstract] In solving certain problems of statistical radio engineering the statistical characteristics must be known for the ratio of mixtures of two random processes, one of which is described by a normal distribution law, while the other conforms to generalized non-gaussian distribution. These characteristics have been found in previous research for special cases where the non-gaussian process conforms to m-distribution, logarithmic-normal or Rayleigh distribution. In this paper, basic results are found that imply various special cases for non-gaussian and gaussian signal models that are encountered in practical problems of statistical radio engineering. Examples are given. References 6: 5 Russian, 1 Western. [6610-268]

USSR UDC 621.375.13

INFLUENCE OF HIGHER HARMONICS IN A SYSTEM WITH PARALLEL AMPLIFICATION CHANNEL

Moscow ELEKTROSVYAZ' in Russian No 7, Jul 79 pp 36-41 manuscript received 29 May 78

BELYAVTSEV, V. M.

[Abstract] Studies are performed, intended to maximize the depth of negative feedback, requiring the use of a logarithmic amplitude-frequency

characteristic of the inverse ratio. Amplifiers of this type, used in multi-channel transmission systems, are designed with additional nonlinear correcting elements in order to assure stability of the position of equilibrium of the system in the large signal operating mode. Amplifiers with parallel amplification channels are developed using the method of harmonic linearization. Calculation of the errors in harmonic linearization in such a system can best be performed individually for each channel, considering the higher harmonics of other channels. This method can be extended to systems with large numbers of channels. Figures 5; references 8: 7 Russian, 1 Western.
[274-6508]

USSR UDC 621.378.9

A SPLIT CONNECTOR FOR AN OPTICAL MULTIFIBER CABLE

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 4, Jul-Aug 79 pp 277-278 manuscript received 17 Feb 78

GAVRILOV, I. A., KNYAZHECHENKO, I. V., KUZNETSOV, V. A., SOSNIN, V. P., and FRANTSESSON, A. V., Institute of Radio Engineering and Electronics, USSR Academy of Sciences, Moscow

[Abstract] The latest trend in the manufacture of connectors for optical fiber cables is using polished terminals, to ensure a precise contact with minimum losses due to scattering and reflection. The problem of centering many fiber strands of a cable relative to the connector axis, typically in holes 0.15 mm in diameter, has been solved by resorting to capillary construction. Metallic capillaries can be made of carbon or alloy steel, glass capillaries can be produced by conventional drawing with subsequent selective sampling. These capillaries are centered inside a terminal case and bonded to it with epoxy resin, whereupon the face is ground and polished. Such terminals with capillaries are seated in calibrated holes of sockets and matching pins. Clean cable fibers are then pulled through the capillaries in each, lined up at the protruding ends with a plate, and then encapsulated with an optical-grade resin. An experimental batch of 20 such socket-pin connectors has yielded an excellent precision of alignment within a few microns and, even without additional quality control, an attenuation of not more than 1-2 dB. Figures 1; references 6: 3 Russian, 3 Western.
[18-2415]

USSR UDC 621.391

OPTIMUM NONLINEAR FILTRATION OF A SIGNAL THAT IS PHASE-MODULATED OR FREQUENCY-MODULATED BY A NARROW-BAND RANDOM PROCESS

Kiev IZV.VUZ: RADIOELEKTRONIKA in Russian Vol 22, No 7, Jul 79 pp 11-17 manuscript received 6 Feb 78

BESPALOV, YE. S. and KULESHOV, V. N.

[Abstract] In radar and radio applications extensive use is made of cw signals which are phase or frequency modulated by the sum of low-frequency and narrow-band rf processes with non-overlapping spectra. Methods of the theory of optimum nonlinear filtration are used in this paper to synthesize physically realizable devices for reception of such signals. The proposed systems optimize discrimination of a signal with phase or frequency modulated by a quasi-harmonic random process against a background of additive white noise. It was found that the optimum systems are phase-locked loops that contain narrow-band filtration circuits that are tuned to the modulation frequency and connected in parallel with the low-frequency feedback channel. Formulas are derived for calculating the errors of these systems. Figures 4; references 6: 4 Russian, 2 Western.
[6610-268]

USSR UDC 621.391.1:519.28

CALCULATING THE EFFICIENCY OF THE MAXIMUM-LIKELIHOOD ESTIMATOR FOR OBSERVATION OF A DISCONTINUOUS SIGNAL SUBMERGED IN WHITE NOISE

Moscow PROBLEMY PEREDACHI INFORMATSII in Russian Vol 15, No 3, Jul-Sep 79 pp 61-69 manuscript received 19 Dec 77

GOLUBEV, G. K.

[Abstract] A discontinuous signal submerged in white noise is considered and an identity involving estimators of the shift parameter is proved, on the basis of three properties of equivariant estimators, for calculating their asymptotic efficiency. With the use of modified Bessel and Hankel functions, accordingly, the asymptotic behavior of the dispersion of the Bayes estimator is demonstrated and the asymptotic efficiency of the maximum-likelihood estimator is calculated, the latter being found to be equal to 0.741 in this particular case. The author thanks R. Z. Khas'minskiy for formulating the problem and scientific guidance, also M. V. Burnashev for helpful critical comments. References 9: 7 Russian, 2 Western.
[12-2415]

USSR UDC 621.391.2

ADAPTATION OF A RANK BINARY DETECTION PROCEDURE

Kiev IZV.VUZ: RADIOELEKTRONIKA in Russian Vol 22, No 7, Jul 79 pp 31-37
manuscript received 15 May 78

AKIMOV, P. S.

[Abstract] The use of rank processing in signal detection problems stabilizes the probability of a fa se alarm and the average number of observations in a compound hypothesis for a sequential rule of decision making, as well as appreciably simplifying the adaptation of the detector. The average number of observations is minimized by a detector that operates on the basis of sequential analysis of the likelihood ratio of the rank vector of observations. However, calculation of the likelihood ratio is a complicated proble.. The author considers simplification of the detection procedure by using an algorithm based on binary quantization of ranks which results in some sacrifice of efficiency but considerably facilitates adaptation. A technique is proposed for calculating the quality characteristics of the procedure and examples of calculation are given. Problems of realization of an adaptive detector are considered. Figures 2; references: 9 Russian.
[6610-268]

USSR UDC 621.391.2

DETERMINATION OF THE WALSH ENERGY SPECTRUM OF A STEADY-STATE RANDOM PROCESS FROM AN ESTIMATE OF THE PERIODOGRAM TYPE

Kiev IZV.VUZ: RADIOELEKTRONIKA in Russian Vol 22, No 7, Jul 79 pp 45-51
manuscript received 22 Mar 78; after revision, 26 Sep 78

AGRANOVSKIY, K. YU., ZHDANOV, A. I. and RESHETOV, L. A.

[Abstract] A simple analytical relation is found between the Fourier spectrum of a steady-state random process and the spectral components of a Walsh periodogram, and an estimate is found for the variance and mathematical expectation, as well as the mutual correlation of the Walsh spectral components expressed in terms of the given Fourier spectrum. Formulas are given for determining the equivalency of energy spectra found in trigonometric and step-function bases. An example is given of Walsh spectra calculated from the derived relations, and it is shown how they change as a function of the effective width of the spectrum of the investigated process for dyadic ordering of the Walsh functions. Figures 1; references 8: 5 Russian; 3 Western.
[6610-268]

USSR UDC 621.391.2

EXPERIMENTAL INVESTIGATION OF A TWO-CHANNEL SPACE DETECTOR AND INTERFERENCE COMPENSATOR

Kiev IZV.VUZ: RADIOELEKTRONIKA in Russian Vol 22, No 7, Jul 79 pp 98-100
manuscript received 10 May 78; after revision, 10 Oct 78

LAZUTKIN, B. A., LAZUTKIN, A. B., MANSUROV, V. V. and POSPELOV, B. B.

[Abstract] In an earlier paper, one of the authors proposed an m-channel receiver that is optimum with respect to maximum likelihood ratio [B. A. Lazutkin, "Some additional Possibilities of Multichannel Detection Systems," RADIOTEKHNIKA I ELEKTRONIKA Vol 17, No 10, 1972, pp 2189-2191]. An analyitical study of a two-channel receiver of the proposed type showed the feasibility of total compensation of steady-state interference produced by an external source located at an arbitrary point of the far zone. To check out the degree of compensation of interference in an actual receiver, the authors did experiments on a two-channel space detector and interference compensator based on the proposed design. The results show that in the absence of a useful signal, it is fairly easy to compensate for narrow-band quasi-harmonic fluctuations produced by a source at an arbitrary angle by 15-30 dB. Compensation by 25-30 dB is realized when the width of the spectrum of interference fluctuations is 10-15 percent of the width of the spectrum of the useful signal at the half-power level. Compensation drops to 12-13 dB when the spectrum of interference fluctuations widens to 30 percent of the width of the useful signal spectrum. The device compensates steady-state narrow-band interference from a source coincident with the useful signal source. In principle, it is possible to determine both the bearing and the range of the source of interference. Figures 2; reference: 1 Russian. [6610-268]

USSR UDC 621.391.3

NONBINARY TELEGRAPHY

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 2, Mar-Apr 79
pp 76-80 manuscript received 3 Mar 78

PETROV, VIKTOR MIKHAYLOVICH, candidate in technical sciences, NIPTIEM (Scientific Research and Design Technological Institute of Electrical Machinery), Vladimir

[Abstract] Transmission of discrete data over existing standard channels is considered and the feasibility of improving the efficiency of these channels by application of new primary codes is demonstrated. Relative

multidigit ($m > 2$) pulse phase manipulation is the method proposed, its main advantage being the possibility of self-synchronization without intervention of service input. Other advantages are a faster transmission of useful data, made possible by optimal nonuniform statistical coding as well as by a shorter elementary time interval depending on the channel quality indicators, also adaptability to channels with frequency multiplexing already available in binary-data transmission systems and possibility of high-density one-track recording of alpha-numeric data on magnetic tape or plastic disks. This method of pulse phase modulation requires continuous data transmission behind a pilot signal. Nonuniform elementary 2-digit coding of letters is the most suitable method of nonuniform multidigit time coding, preferable to the Morse code and the International Telegraph code 2, as shown by an analysis of code matrices. In a tradeoff between a triangular matrix and a square matrix, moreover, a latter one is found to be slightly less time efficient but more efficient in terms of nonuniform coding. Figures 2; tables 4; references: 5 Russian.
[13-2415]

USSR

RESULTS OF INSPECTION OF TELEGRAM FLOWS IN THE GENERAL-USE NETWORK

Moscow VESTNIK SVYAZI in Russian No 6, Jun 79 pp 22-24

TULUPOV, A. I., deputy chief, Main Telegraphic Administration of USSR Ministry of Communication; DZHULAY, L. A., senior scientific worker of KONIIS [Kiev Affiliate of Central Scientific Research Institute of Communications] and KOLCHENKO, G. F., junior scientific coworker

[Abstract] Pre-holiday and holiday telegram flows were studied at 155 general-purpose oblast, kray and republican junctions of the telegraph network from 18 Dec 76 through 2 Jan 77, plus another 66 junctions. All forms of telegrams were monitored: paid, official, phoned-in, institutional, etc. A YeS-1020 computer was programmed by KONIIS to determine the structure of telegram flows during holidays as well as the relationship between telegrams sent directly and those transmitted by overflow equipment. Total number of all types of telegrams sent during the holiday period was 24,035,000. The load increased toward the end of December, with a subsidence only on Saturdays and Sundays when operations are limited. The peak load was observed from the 27th through the 31st of December: during that period, 42.7 percent of all telegrams of the entire study period or 50.1 percent of holiday telegrams were sent. It was found that 45 percent of auxiliary lines and 29.3 percent of increased lines were used inefficiently and should not have been opened. Per capita use of holiday telegrams in the entire country was 0.027 telegram, or more than one telegram

for every five persons. About 130,000 institutional greetings telegrams were sent during the holiday period; about 600,000 such telegrams are sent per year, wasting over 500,000 rubles of state funds. This also generates an additional telegram load. The tax surcharge was also shown to have little effect on the distribution of telegram loads. Figures 4.
[237-8617]

USSR UDC 621.391.13

LIMIT OF THE RANGE OF PERMISSIBLE SPEEDS IN ASYNCHRONOUS COMMUNICATION OVER A SYMMETRIC BINARY CHANNEL

Moscow PROBLEMY PEREDACHI INFORMATSII in Russian Vol 15, No 3, Jul-Sep 79 pp 18-23 manuscript received 21 Feb 78

GRIGOR'YEV, A. A.

[Abstract] A symmetric binary channel with two inputs is considered and the coding problem is analyzed, with regard to the feasibility of asynchronous transmission. The ranges of the two code speeds are established, with known constraints on their sum, on the basis of a theorem regarding the existence of block codes which, when sufficiently long, will ensure sufficiently low error probabilities at all lags. This theorem is proved with the aid of two lemmas and it established the lower limit of permissible code speeds. In two parts of the 3-part region in the speed plane this limit coincides with the well known upper limit. Figures 1; references: 2 Western.
[12-2415]

USSR UDC 621.391.81

ESTIMATION OF CORRELATION FUNCTIONS USING COMPRESSED DATA

Kiev IZV.VUZ: RADIOELEKTRONIKA in Russian Vol 22, No 7, Jul 79 pp 89-91 manuscript received 27 Mar 78

DENISYUK, V. D.

[Abstract] An examination is made of problems of evaluating the correlation function and energy spectrum of a random process with respect to a realization that is processed by certain compression algorithms without preliminary reconstruction of the coded data. The analysis applies to an

ergodic cnetered process, assuming that realizations are known at certain instants. The principle of data compression by parametric algorithms is explained. The estimation of the correlation function and energy spectrum is done by an indirect technique in which an estimate of the energy spectrum is constructed first, and the correlation function is then estimated by the inverse Fourier transform. The estimates of the energy spectrum apply to equally spaced frequencies, so that the fast Fourier transform algorithm can be used in finding the inverse Fourier transform. The estimate of the correlation function is cyclic because of the periodic nature of the trigonometric system of orthogonal functions used in the theory of Fourier series. References: 5 Russian.
[6610-268]

USSR UDC 621.391.82

COMMUTATIVE DESIGN OF PASSIVE INTERFERENCE PROTECTION SYSTEMS

Kiev IZV.VUZ: RADIOELEKTRONIKA in Russian Vol 22, No 7, Jul 79 pp 108-110 manuscript received 10 Apr 78; after revision, 12 Sep 78

KOSHEVOY, V. M.

[Abstract] Methods of analog tuning of filters involve considerable technical difficulties, and do not ensure the required efficacy. Efficacy in tuning band-elimination filters can be ensured by commutative design with a considerable reduction in the required number of commutated elements by basing the band-elimination filter on several filters with identical frequency responses and differing only in tuning frequency. Appropriate combination of such filters provides a resultant frequency response of the required shape. The author considers an example of design of a commutation band-elimination filter for the case where the signal emitted by the transmitter is a sequence of coherent unmodulated pulses. It is shown that the depth of band elimination for the proposed filter, as well as the uniformity of its frequency response in the region of transparency are determined mainly by the level of the maximum side lobe of the modulus of the frequency response of the partial channel between peaks of indeterminacy. The width of the band-elimination region can be adjusted over a wide range by the number of disengaged partial channels. The proposed filter can also realize several band-elimination regions, which is important for organizing protection against interference with fluctuation spectra that have several humps. References 3: 2 Russian, 1 Western.
[6610-268]

USSR UDC 621.391.156

UPPER LIMITS FOR THE PROBABILITIES OF DECODING ERRORS IN SOME BROADCAST CHANNELS

Moscow PROBLEMY PEREDACHI INFORMATSII in Russian Vol 15, No 3, Jul-Sep 79 pp 3-17 manuscript received 8 Dec 77; after revision, 28 Nov 78

KUDRYASHOV, B. D. and POLTYREV, G. SH.

[Abstract] A discrete broadcast channel with two receivers is equivalent to a pair of discrete channels with a common input and two different outputs separated in space. Here the decoding of block codes and of grid codes is analyzed and the upper limits for the probability of decoding error are established in each case, on the basis of respective theorems the proofs of which are also given. These limits are found to be more accurate than those according to R. Fano and R. G. Gallager. The method of estimation is now applied to a broadcast channel consisting of two symmetric binary channels without memory and the upper limit for the error probability again established, with the aid of special relations for this case. Figures 5; references 9: 2 Russian, 7 Western.
[12-2415]

USSR UDC 621.391.837:621.371.222

SPECIFICS OF THE PROPAGATION OF VERTICALLY POLARIZED WAVES IN A TV BROADCASTING NETWORK

Moscow ELEKTROSVYAZ' in Russian No 7, Jul 79 pp 5-8 manuscript received 4 Nov 78

SHUR, A. A., MEL'NIKOV, B. F.

[Abstract] An analysis is presented of experimental data on the propagation of vertically polarized VHF and UHF waves. The analysis is based on statistical data published in Soviet and foreign journals. In particular, the variation of signal level with type of polarization is studied for various types of terrain, the degree of depolarization of waves and the influence of polarization on TV signal reception quality are studied. It is concluded that vertically polarized (VP) waves can be best used for TV in nonforested areas. This type of polarization can also be used in ordinary broken terrain with a transmitter antenna height of 150-300 m. Powerful VP broadcast stations should be several kilometers from the nearest receiving antenna. Since forested areas may act as shields for vertically polarized waves, caution must be used in selecting receiving antenna locations. References 12: 5 Russian, 7 Western.
[274-6508]

USSR UDC: 621.394.4

THE BASE PRINCIPLE OF CHANNEL FORMATION IN TONAL TELEGRAPHY APPARATUS

Moscow ELEKTROSVYAZ' in Russian No 7, Jul 79 pp 19-21 manuscript received 8 Dec 76

SHATS, YU. YA., TARASOV, V. N. PROTSENKO, V. M., SHNIR, M. A., TURBIN, V. and VASHKEVICH, S. N.

[Abstract] One of the main trends in improvement of the quality of tonal telegraphy apparatus with FM is the base principle of formation of telegraph channels. The 50-baud TT system developed in the Soviet Union uses 24 identical modems consisting of a frequency modulator, band pass filter and mixer at the transmitting end, with a balance mixer, 2 band pass filters, buffer amplifier and frequency demodulator at the receiving end. Testing of this equipment, plus the 100 and 200 baud systems, has indicated that they operate satisfactorily. Series production and operation of this apparatus will represent an important stage in the development of communications technology in the USSR. Figures 2; references 4: 3 Russian, 1 Western.
[274-6508]

USSR UDC: 621.394.6:621.314

SEQUENCED POWER SUPPLY UNITS FOR TELEGRAPH APPARATUS

Moscow ELEKTROSVYAZ' in Russian No 7, Jul 79 pp 16-19 manuscript received 27 Jan 77

LEVINZON, S. V.

[Abstract] One method of improving the operational reliability of accuracy of information transmitted and received in telegraph systems is to switch the power supply voltage on and off in a definite sequence. Sequenced power supplies help to improve operating indices, and should be connected to the group of electromagnets at stepping motors and functionally terminated apparatus such as the transmitter, repuncher, printer, etc. Where the voltages involved in the telegraph apparatus are small, transisterized sequenced power supplies can be used, with thyristors used for electromagnets and switching motors. Figures 5; tables 2; references: 6 Russian.
[274-6508]

USSR UDC: 621.394.625.3

DETERMINATION OF THE PARAMETERS OF THE PRINTER OF A TELEGRAPH APPARATUS

Moscow ELEKTROSVYAZ' in Russian No 7, Jul 79 pp 14-16, manuscript received 20 Oct 77

STEPIN, S. I.

[Abstract] An analysis is performed of the actual operatior involved in performing a CR/LF in a teletype printing device in which the CR/LF combination is internally generated (not transmitted over the line). This requires the use of a buffer memory to avoid loss of characters during the CR/LF cycle. The capacity of the buffer, carriage return speed and printing speed must be coordinated to minimize dynamic stress on the mechanical elements of the printer while assuring that no characters will be lost. The design method advocated is to set a fixed CR/LF cycle time, then assign the other parameters of the system to assure that the buffer will have sufficient capacity to store characters arriving during the CR/LF, and the printer can empty the buffer fast enough to be sure it is empty by the next CR/LF. Figures 2; references: 5 Russian.
[274-6508]

USSR UDC 621.394.763

MEASUREMENT AND CHECKING OF PARAMETERS OF TRAFFIC AT TELEGRAPH COORDINATE STATIONS

Moscow ELEKTROSVYAZ' in Russian No 7, Jul 79, pp 10-13 manuscript received 8 Jun 77

ROZHKO, A. V., VRAZHNOV, V. N.

[Abstract] Traffic parameter measurement and testing systems for use at coordinate switching stations of the telegraph network are used for testing of the quality of servicing of calls and measurement of all parameters of the traffic necessary for station operating personnel to plan corrective operations, i.e., analysis of the mode on the station and the throughput capacity of the equipment in order to determine any additional equipment needed as the station develops. The system also accumulates statistical data needed by planning organizations for long-term network planning and collects the information required for the functioning of the network control system. Existing methods and equipment used to generate and collect this information are briefly described. Recommendations of international committees for traffic parameter measurement and testing equipment are discussed. Automatic devices for recording of traffic, for use with the

domestic AT-PS-PD and APT-K coordinate telegraph switching stations, have been developed and are currently in the stage of preparation for manufacture. References 8: 5 Russian, 3 Western.
[274-6508]

USSR UDC 621.396.626

INTERFERENCE IMMUNITY OF FREQUENCY RADIOTELEGRAPHY UNDER THE INFLUENCE OF AN ACTUAL ATMOSPHERIC NOISE FIELD

Kiev IZV.VUZ: RADIOELEKTRONIKA in Russian Vol 22, No 7, Jul 79 pp 18-24
manuscript received 26 Jul 78; after completion, 12 Dec 78

KUZ'MIN, B. I.

[Abstract] A technique is proposed for engineering analysis of the interference immunity of frequency radiotelegraphy when the receiver is subject to atmospherics that contain a noise background and grouped pulse interference. The proposed method accounts for the working algorithm of the resolver in reception of discrete signals and the distribution of interference amplitudes in the formula for the conditional error probability, and also takes into consideration flux inhomogeneities and the particulars of the selecting circuits of the reception channels in the formula for the unconditional probability of appearance of pulse interference. The proposed formulas do not account for the redistribution of energy between the pulse and fluctuation components of the interference that takes place due to the restricted bandwidth of the selecting channels, nor is consideration taken of correlations with grouping of the pulse interference. Figures 1; references 13: 7 Russian, 6 Western.
[6610-268]

USSR UDC 621.398.53.082.32

TRANSMISSION OF DISCRETE PNEUMATIC SIGNALS THROUGH A WIRE COMMUNICATION LINE

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 7, Jul 79 pp 20-22

LIMONOVA, M. YE., candidate in technical sciences, and CHERNYSHEV, V. I., engineer

[Abstract] Communication devices are considered that combine the speed of electronics with the safety of fluidics. These devices are based on special facilities for transmitting discrete pneumatic signals through electric wires without electric power supply. These lines use piezoceramic elements on both the transmitting and receiving end. These elements are the basis for fluidic-to-electric and electric-to-fluidic converters. The new communication channels increase the speed of transmission of discrete pneumatic signals by a factor of 200, and extend the range by a factor of 20. The construction of the converters is described, and techniques for pneumatic signal transmission are discussed. The logical "1" level for input and output signals is 1.4 $\pm$ 10 percent gage atmospheres for a "0" level of 0.2 $\pm$ 10 percent gage atmosphere. The electric power of the transmitted signals is a few microwatts, and the transmission rate is less than 30 Hz. Figures 6.
[6610-277]

USSR UDC 656.25-50.656.22.05

THE TL-76 LOCOMOTIVE REMOTE CONTROL SYSTEM

Moscow AVTOMATIKA, TELEMEKHANIKA I SVYAZ' in Russian No 5, 1979 pp 14-18

BARANOV, L. A., professor, Moscow Institute of Railroad Transport Engineering, Doctor in Technical Sciences; SOLYUS, P. G., department chief, Moscow Institute of Railroad Transport Engineering, Candidate in Technical Sciences; MIKHAYLOV, A. F., section chief, All-Union Institute of Railroad Transport, Candidate in Technical Sciences; and KISELEV, L. M., chief engineer of experimental loop, All-Union Institute of Railroad Transport

[Abstract] The All-Union Scientific-Research Institute of Railroad Transport (VNIIZhT) in cooperation with the "Automatic Control of Train Movement" Laboratory of the Moscow Institute of Railroad Transport Engineers, has developed a remote control system to allow control of electric locomotives from a central control panel with no human beings aboard, allowing testing of tracks and rolling stock to be continued to the point of complete failure without danger to human life. Communications are by a half-duplex radio channel and a duplex channel through the power line. A structural diagram of the equipment used at the central control post and a diagram of the control pulses sent to the locomotive during a test are presented. Photographs of the control panel and the rack of radio equipment on board the locomotive are shown. The TL-76 system is made entirely of series K 133 microcircuits, and is capable of controlling all of the variables required for operation of an electric locomotive. Figures 5.
[287-6508]

USSR UDC: 656.254.16:621.396.931

PROSPECTS FOR THE DEVELOPMENT OF RADIO COMMUNICATION IN RAIL TRANSPORT

Moscow AVTOMATIKA, TELEMEKHANIKA I SVYAZ' in Russian No 5, 1979 pp 3-6

ARKATOV, V. S., chief, Main Administration of Signals and Communications, Railroad Ministry, Candidate in Technical Sciences; DOTSENKO, N. YE., chief of radio communications department; and VOVANOV, YU. V., chief of radio communications laboratory, All-Union Scientific-Research Institute of Railroad Transport (VNIIZhT), Candidate in Technical Sciences

[Abstract] The number of radio sets in use in the railroads has doubled in the first 4 years of the 10th Five Year Plan. A number of scientific and technical problems which must be solved in order to satisfy the full demand for radio communications on the railroad is listed, including: assurance of high quality and reliability of radio communication, in spite of the high noise levels encountered; increasing the number of channels by effective utilization of the electromagnetic spectrum; organization of operation of large numbers of radio sets in a single area without mutual interference (electromagnetic compatability problems); creation of maximum convenience in the use of radio equipment by various categories of workers; development of optimal methods for transmission of discrete information with the required reliability; creation of radio networks with equally accessible channels in order to increase effectiveness of channel utilization; and assurance of high reliability and methods of automatic testing. Types of radio communication devices used and typical areas of application are outlined, showing a general trend toward subdivision of radio communication into communications directly participating in the transport process and communications supporting technical servicing of railroad and transport equipment. Figures 2.
[287-6508]

USSR UDC 656.257-83:621.398

TEST DEVICES USED WITH THE "LUCH" CENTRAL DISPATCHER SYSTEM

Moscow AVTOMATIKA, TELEMEKHANIKA I SVYAZ' in Russian No 5, 1979 pp 7-11

YEGORENKOV, N. G., deputy laboratory chief, All-Union Scientific-Research Institute of Railroad Transport (VNIIZhT)

[Abstract] A number of articles, including this one, are currently being published in order to familiarize a broad range of workers involved in regulation and servicing of the "Luch" centralized dispatcher's system hardware with the test devices which must be used during adjustment, regulation

and operation of the equipment. The test equipment includes: a central test panel used to check and adjust the "Luch" system apparatus, check the parameters of its semiconductor elements, as well as the electric and time characteristics of the code relays; a test panel, to be used to check the operation of code devices at the central dispatcher's post; a test instrument to check the operation of the code devices at each line point. The procedure is outlined for testing the hardware used in central dispatcher's channels, the channel oscillator and amplifier. The description of the system for testing the channel-forming apparatus will be continued in the next issue of this journal. Figures 2; tables 2.
[287-6508]

USSR

TRAIN DISPATCHER COMMUNICATIONS ON THE RAILROADS OF HUNGARY

Moscow AVTOMATIKA, TELEMEKHANIKA I SVYAZ' in Russian No 5, 1979 pp 44-47

ZDOROVTSOV, I. A., chief of design and research department for wire communications, Design Bureau, Central Staff, Railroad Ministry

[Abstract] The Hungarian railroad system makes extensive use of train telephone communications with both selector and tone-selective calling. The two types of communication are briefly described, and equipment used is illustrated by photographs. The principle of operation of the NA.00.10 dispatcher's communication system is analyzed.
[287-6508]

USSR

CALCULATION OF THE RANGE OF COMMUNICATIONS OF TYPE ZHR-U RADIO SETS

Moscow AVTOMATIKA, TELEMEKHANIKA I SVYAZ' in Russian No 5, 1979 pp 42-43

Unsigned

[Abstract] A convenient method has been developed for calculation of the range of radio communications using type ZHR-U radio sets, which are commonly used on the railroads. The method of calculation is based on the use of graphs of the variation in field intensity as a function of range for various antenna heights, produced by statistical studies. The reverse problem can also be solved by the same method, determining the necessary antenna height for any desired range. Figures 2; tables 1.
[287-6508]

USSR UDC 681.3:621.39

DESIGN AND USE OF THE "NEVA" FAMILY OF CONTROL SYSTEMS

Moscow ELEKTROSVYAZ' in Russian No 7, Jul 79 pp 27-31 manuscript received 4 Oct 77

BESKIND, A. A., SHLYAPOBERSKIY, V. I., SHTAGER, V. V.

[Abstract] Automatic telephone exchanges operating in real time require the use of a specialized electronic control computer with a specific instruction set designed for control of telephone exchanges. The architecture and instruction set of the "Neva" computer are discussed. A figure shows a block diagram of the Neva 1 control system, designed for automatic telephone exchanges. For a telephone exchange with 4 to $32 \cdot 10^3$ subscribers, with a specific subscriber load of 0.1 Erl, assuming 20 percent of the load is connected within the exchange, the control system can serve from 5 to 40 calls per second. For a transit unit with a specific load on the connecting line of 0.6 Erl, the control system can service from 17 to 100 calls per second with a capacity of 2 to 12,000 inputs (channels). The Neva system is the USSR's first centralized program controlled telephone switching system. Experimental operation of this equipment in the telephone network of Leningrad has demonstrated the basic advantages of centralized programmed control. Figures 1; tables 2; references: 3 Russian.
[274-6503]

USSR UDC 681.321.64

A DIGITAL PHASE AFC SYSTEM

Kiev IZV.VUZ: RADIOELEKTRONIKA in Russian Vol 22, No 7, Jul 79 pp 100-102 manuscript received 14 Jul 78

SHISHKIN, A. V.

[Abstract] A necessary condition for effective operation of digital and discrete data transmission systems is clock synchronization. A wide lock-in band is an important requirement for phase synchronization devices. This requirement is not met by digital phase AFC systems of first order with pulse addition or elimination in the feedback circuit. In this paper the author considers a digital phase AFC system of second order used as a clock frequency demodulator. It is shown by the "direct method" of Lyapunov for stability investigations that the lock-in band of the system is equal to the holding band, and an estimate is given for the number of steps in the transient mode. Figures 3; references 3; 2 Russian, 1 Western.
[6610-268]

USSR UDC 621.396.621.38

QUASI-OPTIMUM ALGORITHMS OF NONLINEAR FILTRATION OF DIFFUSION MARKOV PROCESSES USING GAUSSIAN SUMS

Kiev IZV.VUZ: RADIOELEKTRONIKA in Russian Vol 22, No 7, Jul 79 pp 79-82
manuscript received 8 Jun 78

SHAKHURIN, A. P.

[Abstract] Quasi-optimum algorithms are developed for nonlinear filtration of diffusion Markov processes using an a posteriori approximation of the probability density function by gaussian sums. The algorithms are represented as a closed system of stochastic differential equations in symmetrized and nonsymmetrized forms with an explanation of the particulars of realizing them on digital computers. The proposed approximation will permit relaxation of the gaussian restriction without any sacrifice of the advantages that hold for gaussian distribution. The closed system of equations that is derived is a set of gaussian filters with corresponding coefficients that characterize the contribution of each of the terms to the overall sum. References 4: 1 Russian, 3 Western.
[6610-268]

USSR

A RADIO RELAY FOR PERIPHERAL UHF COMMUNICATION SERVICE

Moscow RADIO in Russian No 7, Jul 79 p 23

BERBICHASHVILI, T., Tbilisi

[Abstract] An examination is made of the principle of constructing radio relays for peripheral service using UHF stations of the "FM" series produced in Hungary. Systems for semiduplex and duplex operation are described. These systems can be used in both commercial and amateur stations. Figures 3.
[279-6610]

USSR

THE PROBLEM OF MUTUAL INTERFERENCE

Moscow RADIO in Russian No 7, Jul 79 pp 10-11

BUNIN, S., radio amateur UB5SUN, Kiev

[Abstract] Mutual interference in amateur radio communications is due largely to poor organization rather than overcrowding. A study of the nature of this interference shows that about 90 percent is caused by an interfering station with operating frequency too close to that of the receiving station, while only 10 percent is caused by emissions from outside of the receiver passband. Interference can be reduced by dividing the amateur band into strictly assigned channels (with spacing of at least 2.5 kHz for SSB transmitters, and 200-300 Hz for cw transmitters). If both the upper and lower sidebands were used in the high-frequency shortwave bands, mutual interference could be minimized. The use of discrete channels with frequency setting within tens of hertz, and frequency stabilizing to the order of 10^{-8} could also reduce mutual interference. It is suggested that experiments be carried out to check the advantages and disadvantages of amateur communications with and without frequency discretization. Figure 1. [279-6610]

USSR

CONSTRUCTION MATERIALS TO BE USED FOR TELEPHONE DUCTING

Moscow VESTNIK SVYAZI in Russian No 7, Jul 79 pp 42-43

KONDRAT'YEV, YU. P., deputy chief of SSKTB, and KABALOV, V. P., chief technologist, Glavsvyaz'stroy, USSR Ministry of Communications

[Abstract] A brief overview of materials, designs and practices used in making conduits for telephone cables in the Soviet Union and elsewhere. The Asbestotsement Scientific Production Association is now developing and testing asbestos-cement multiple-conduit panels to accommodate 2-6 cable ducts of 100 mm diameter. The material used in making these panels is more ple[illegible] than the grade of asbestos that must be used for making conventi[illegible]e conduits. Concrete cable blocks are still being used in East Germany, Bulgaria and Hungary, but are being largely replaced in the United States, Great Britain, France, Italy and other nations by blocks of more effective materials such as high-density and low-density polyethylene, polypropylene and so on. These plastic pipes are being used more and more in the Soviet Union as well. In 1978, the Plastik Scientific Production

Association and Glavsvyaz'stroy developed foam PVC pipes for cable ducting. Their low weight and ease of cementing makes them good candidates for replacing asbestos-cement conduits. Fiber-pitch pipes are now being experimentally produced. The material for these pipes is paper pulp impregnated with heat-resistant pitch. These pipes are to be line-tested in 1979-1980. Tables 1.
[6610-275]

USSR UDC 621.372.5

CHARACTERISTICS OF MATCHED DIGITAL FILTERS FOR LINEAR-FREQUENCY MODULATED SIGNALS

Kiev IZV.VUZ: RADIOELEKTRONIKA in Russian Vol 22, No 7, Jul 79 pp 95-98
manuscript received 26 Dec 77

VOLKHONSKIY, V. V. and CHADOVICH, I. I.

[Abstract] There are two kinds of algorithms for realizing the necessary amplitude-frequency and phase responses of matched digital filters: recursive and non-recursive. Methods of synthesizing the desired amplitude-frequency response have been thoroughly worked out for recursive algorithms. Methods of synthesis of non-recursive algorithms provide the simplest means of getting predetermined amplitude-frequency and phase responses Error accumulation is eliminated in non-recursive algorithms. In this paper the authors synthesize a non-recursive matched digital filter for linear-frequency modulation (LFM) in the time and frequency regions. Figure 1, references: 4 Russian.
[6610-268]

USSR UDC 621.372.54.037.372:621.391.26

REAL CHARACTERISTICS OF DIGITAL FILTERS FOR SIDE LOBE SUPPRESSION BASED ON DISCRETE FOURIER TRANSFORM ALGORITHMS

Kiev IZV.VUZ: RADIOELEKTRONIKA in Russian Vol 22, No 7, Jul 79 pp 25-30
manuscript received 12 Jun 78

BRITIN, S. N. and IPATOV, V. P.

[Abstract] An analysis is made of digital side lobe suppressing filters based on discrete Fourier transform algorithms with consideration of the restricted bit configuration of trigonometric coefficients, assuming that the computing device used fixed-decimal representation. A relation is found between the accuracy of representation of the trigonometric coefficients of the transform and the dynamic range of resolvable signals. Figures 1; references 9: 8 Russian, 1 Western.
[6610-268]

USSR UDC 621.372.543.2

SYNTHESIS OF DIGITAL NARROW-BAND FILTERS FOR FREQUENCY SEPARATION OF CHANNELS

Moscow ELEKTROSVYAZ' in Russian No 7, Jul 79 pp 47-51 manuscript received 21 Feb 79

VITYAZEV, V. V., ALPATOV, B. A., STEPASHKIN, A. I.

[Abstract] When computers are used as information consumers in multichannel transmission systems with frequency separation of channels, the parameters of the transmission system must be highly stable and high frequency selectivity must be achieved with minimum distortion of the transmitted message. Channel separator equipment is improved by the use of narrow-band digital filters, which have significant advantages over analog filters, particular for low and infralow frequencies. A method is developed for synthesis of a set of digital filter-demodulators which can increase the operating speed of the demodulators. Hardware and machine time costs are greatly reduced. Figures 4; references: 3 Russian. [274-6508]

USSR UDC 681.3.26

CONDITIONS FOR THE ABSOLUTE STABILITY OF PROCESSES IN RECURSIVE DIGITAL FILTERS

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 5, Aug 79 pp 76-85 manuscript received 1 Jun 78

GOL'DENBERG, L. M. and MATYUSHKIN, B. D., Leningrad

[Abstract] A digital recursive filter can be represented as a nonlinear system in which nonlinearities are caused by quantization of the readings of input and output signals and by rounding of the results of arithmetic operations, as well as by possible overflowing of the filter's output register. A study is made here of the conditions for the stability of second-order fixed-point recursive digital filters, taking into account the finite length of all registers and the possible overflowing of the output register. A structural diagram is given for this type of filter, along with the nonlinear characteristic caused by the finite number of bits in the filter's output register and the nonlinear characteristic caused by the finite number of bits in the filter's product registers, for the case when the results obtained are rounded in the performance of arithmetic operations. Two other forms of the structure of a recursive digital filter are shown,

one of which has a single instance of nonstationary nonlinearity caused by the finite number of bits in the output register, and the other of which has a linear structure in which the input signal is the sum of the input signal of the filter in the first example and of the noise. Definitions are given of the stability of processes in a recursive digital filter and of the class of input signals. Conditions are found for the absolute stability of processes in recursive digital filters. Recommendations are given on selecting the length of registers. It is demonstrated that if the bit configurations of recursive digital filter registers are selected to take into account the equations derived here and the conditions derived here are fulfilled, the filter will be stable even in the case of possible overflowing of the output register with the nonlinear overflow characteristic given here. A method is described for eliminating instability in a recursive digital filter. This method can be employed in designing recursive digital filters whose dynamic range is less than the maximum possible range for a specific class of input signals. The conditions arrived at for the stability of a second-order recursive digital filter, the recommendations for selecting the bit configurations of registers and the method of eliminating filter instability can be used in designing real digital filters for various types of discrete information transmission and processing systems. Figures 4; references 9: 5 Russian, 4 Western.

USSR UDC 621.372.825

MEASUREMENT OF HIGH-FREQUENCY FIELDS IN RESONATOR CAVITIES

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 4, Jul-Aug 79 pp 180-182 manuscript received 17 Feb 78

ANDLENDER, V. L. and PANFILOV, A. D., Institute of Nuclear Physics, Siberian Division of the USSR Academy of Sciences, Novosibirsk

[Abstract] The distribution of high-frequency electromagnetic fields in resonator cavities can be very accurately measured with an oscillator, by the frequency shift due to insertion of a probe into the cavity space. A G4-4 vacuum-tube oscillator was used for such measurements in a proton accelerator of a cyclotron, with a thin spherical shell 10 mm in diameter made of acrylic glass and full of distilled water serving as the probe. The main source of error is drift in time. Here the maximum attainable accuracy is evaluated on the basis of analytically describable field distribution and found to be within 6 percent at 125 MHz with a maximum frequency drift of 1.6 kHz. Figures 3; references: 8 Russian. [18-2415]

USSR UDC 621.372.826

CALCULATION OF A FLUTED WAVEGUIDE WITH DIELECTRIC FILLER

Kiev IZV.VUZ: RADIOELEKTRONIKA in Russian Vol 22, No 7, Jul 79 pp 72-75
manuscript received 20 Jul 78

ZABOLOTNYY, K. V. and MALYKHIN, M. V.

[Abstract] An analysis is made of a waveguide in the form of a metal trough of rectangular cross section filled with a dielectric. A dispersion equation is found for this structure by a spectral-domain approach with joints in the space of Fourier transforms. A generalized form of the waveguide is considered in which the open side is covered by flanges with a longitudinal gap between them. The formula derived for calculating the dispersion characteristics of the structure is verified by comparison with experimental results. The results show that the proposed technique is accurate and effective. Figures 3; references 3: 1 Russian, 2 Western.
[6610-268]

USSR UDC 621.372.854.016

MULTICHANNEL ELECTRONIC SELECTOR SWITCHES

Kiev IZV.VUZ: RADIOELEKTRONIKA in Russian Vol 22, No 7, Jul 79 pp 70-72
manuscript received 27 Apr 78; after revision, 19 Oct 78

ABRAMOV, V. S. and LEBEDEV, V. K.

[Abstract] A multithrow PIN-diode switch is described with series-parallel diode connection. The maximum frequency is determined by the admissible level of reflectance in the open channel, and the minimum frequency is determined by the isolating properties of the inductance for closing the direct current of the diodes connected in opposition at the input, and the unit for isolating the microwave channel from the controlling voltage source. A modular modification of this switch is considered that consists of a hollow metal cylinder into which three coaxial lines are fed in the radial direction. The terminal ends of the inner conductors are mechanically flattened to accommodate the leads of the switching diodes, and projections are provided on the inner wall of the cylinder for other diode leads. The units for isolating the microwave channels from the controlling voltage sources are 3 element low-frequency filters with cutoff frequency of 50 MHz. Coaxial links are used in place of isolating capacitors for the input and output signals. The proposed design is inexpensive and simple, and combines high electrical properties with light weight and small size. Figures 2; references 3: 1 Russian, 2 Western.
[6610-268]

USSR UDC 621.396.692.001.4

ELECTRICAL CHARACTERISTICS OF RNS-60 ZINC OXIDE RESISTORS

Moscow ELEKTROTEKHNIKA in Russian No 7, Jul 79 pp 29-32 manuscript received 8 Dec 78

ALEKSANDROV, V. V., candidate in technical sciences, and PRUZHININA, V. I., candidate in physicomathematical sciences

[Abstract] Data are given on the RNS-60 zinc oxide resistors developed at the All-Union Electrical Engineering Institute imeni V. I. Lenin for spark gaps on high-voltage line protectors. These resistors are 60 mm in diameter and 10 mm in height, and have much greater nonlinearity than the conventional silicon carbide resistors currently used in such spark gaps. The maximum voltage across these resistors with direct current of 1 mA is 1.4 kV. The current-vs-voltage characteristics of the resistors are given, and also the curves for power dissipated in the resistor as a function of the applied DC and AC voltage. The temperature coefficient of current change is no more than +3 percent/°C, and the temperature coefficient of voltage change is no more than -0.55 percent/°C. Results of stability tests are discussed. The height of a series-connected limiter column for 110 kV is 1000-1300 mm. These resistors can be used in single-column limiters where the duration of the maximum permissible surge does not exceed 3-4 s. Figures 4.
[6610-278]

USSR UDC 621.3.049.75.002

EXPERIMENT IN PUNCHING HOLES IN PRINTED CIRCUIT BOARDS WITH PARTIAL METALIZATION WITH FOIL

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 5, 1979, p 40

ZUBOVSKIY, B. S., candidate in technical sciences, and SVIRNOVSKIY, D. G., engineer

[Abstract] A description is given of a method, introduced at the Minsk "Gorizont" Production Association, for punching holes in circuit boards made of a dielectric covered with foil on one side, of the type GF1-35-1,5 mm, which includes partial metalization of the holes with the foil. Specially designed punches designed by the association in conjunction with Riga Polytechnical Institute make it possible to punch in a single stroke up to 200 holes in printed circuit boards with a spacing of up to 2.5 mm. In the process the punch draws a small band of foil into the hole so that a surface wetted with solder is formed, as a result of which the quality

of soldering is improved and the number of unsoldered areas is reduced. The reliability of soldered joints is improved because of the increase in the height of the solder in the space between the wall of the hole and the lead of the electronic component. The design of the punch makes it possible to grasp the foil directly in the punching area and for the die to follow a steady line in the working stroke, which makes it possible to improve the stability of punches and to punch printed circuit boards without preheating them. Other advantages of this method are the fact that the material of the board separates less into layers around holes and adhesion of the foil to the substrate has been improved because of the fact that the foil is drawn into the hole. The number of unsoldered connections when soldering with a "Volna" unit has been reduced as much as 30 percent, the consumption of solder has been reduced 10 percent and labor productivity has increased 30 percent because of less frequent manual additional soldering. The savings from introducing this process has equaled 53,000 rubles per year. References: 1 Russian.

USSR UDC 621.38:771.97

PHOTOGRAPHIC TEMPLATES FOR DRILLING PRINTED CIRCUIT BOARDS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 5, 1979 p 41

KATOV, V. N. and SOLDATOVA, A. T., engineers

[Abstract] A method is recommended for speeding up the fabrication of printed circuit boards and reducing the number of errors in drilling by using instead of drawings a photographic template, in the form of a photographic print of a picture of the face side of a printed circuit board made on GOST [All-Union State Standard] 10752-74 matte photographic paper in a negative image by contact with a photographic stencil. On this template the diameters of holes are color coded in contrasting colors. It is recommended that the background be gray and that holes which must be singled out from the entire group be indicated in bright colors. Because holes with a diameter of $0.8^{+0.1}$ mm predominate on printed circuit boards, it is not necessary to code them. It is recommended that holes with a diameter of $1.3^{+0.12}$ mm be colored red and holes with a diameter of $1.8^{+0.2}$ mm, blue. Attached to the photographic template is a table of holes indicating the holes' designation, diameters in millimeters, the diameter of the countersink bit, the presence of metalization, the number of holes, the roughness of the surface, the last name of the performer of the job, his signature and the date. The designer-developer makes up the photographic template with the table. Among the advantages of this method over the old method of using drawings are that the fabrication of mockups of products is sped up because time is not spent on making drawings of circuit boards and in

copying and duplicating them, errors introduced in copying a drawing are eliminated, the number of errors in drilling is reduced because of color coding, and labor productivity is improved because of a reduction in eye strain on the part of the driller. It is suggested that these templates can also be used in series production.

USSR UDC 681.3.29./16

DESIGN OF A STANDARD PRINTED-CIRCUIT BOARD

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 2, Mar-Apr 79 pp 81-85 manuscript received 13 Feb 78; after completion, 20 Nov 78

GOROSHCHENKO, ALEKSEY GAVRILOVICH, engineer; MITULINSKAYA, MAYYA ANDREYEVNA, engineer, Both of Special Design Office for Mathematical Machines and Systems, Institute of Cybernetics, Ukrainian SSR Academy of Sciences, Kiev

[Abstract] A method of designing printed-circuit boards for microelectronic equipment and substrates for multichip LSI systems is proposed which yields a dense packaging of components with a sparse wiring. The gist of the method is to optimize the geometrical dimensions of and the geometrical relations between all components by means of bifurcation of connections, intersection of channels and alternative routing. As optimization criteria serve the overlap factor, which characterizes the discreteness of conductors, and the overall minimum intersection of channels by connections. The principle is applicable to multilayer as well as bilateral board assemblies, as demonstrated on a general design procedure for series-155 microcircuits. A typical example is a successful packaging of standard electrical components of a Unified System YeS computer on a standard printed-circuit board by this method. Figures 3; references 9: 8 Russian, 1 Western.
[13-2415]

USSR UDC 531.74.087.92

ACCUMULATING ANGLE-TO-CODE CONVERTERS BASED ON OSCILLATORY PICKUPS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 7, Jul 79 pp 29-30

PUKH, A. P., candidate in technical sciences, SUKHOBRUS, L. A., KUZNETSOV, V. N. and KOSTENKO, V. I., engineers

[Abstract] The article describes the KVD-3 oscillatory pickup used as a conversion element in accumulating angle-to-code transducers. This pickup is an amplitude converter that has relay control characteristics. Movement of a tooth on a metal disk through the working gap of the pickup generates or interrupts self-oscillations. The value of the feedback factor at which excitation or interruption of self-oscillations occurs depends on the supply voltage. Therefore at some threshold value of this factor, engagement and disengagement of the pickup may be observed due to pulsations of the supply voltage. Special pulse shapers have been developed to improve the accuracy of the converters. Two modifications of reversible accumulating converters based on KVD-3 pickups with the use of elements of the Logika-T series have been developed at the Kiev Engineering Construction Institute. These converters are used in an automatic system for controlling discrete-action dispensers for checking the mass of components of a concrete mixture, and also for monitoring the flowrate of cement during batching, and have successfully undergone industrial testing at the Kiev Stroyindustriya Combine. Figures 2; references: 4 Russian.
[6610-277]

USSR UDC 531.787.92:621.315:531.781.2

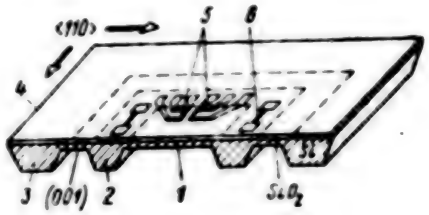
A DOUBLE-MOUNTING SILICON DIAPHRAGM SENSING ELEMENT

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 7, Jul 79 pp 30-31

POLIVANOV, P. P., engineer

[Abstract] An integrated diaphragm sensing element with double mounting is described. This type of sensor is a locally thinned region in a semiconductor single crystal, forming a diaphragm framed by a mounting. Strain-sensing structures on the diaphragm convert deformation to an electric signal. The figure shows a diagram of the proposed sensor, which is a silicon single crystal in which local diaphragm 1 has been created. The peripheral region of the crystal that frames the diaphragm forms a mounting divided into two concentric parts 2 and 3 joined by thinned silicon layer 4. Strain-gage resistors 5 are formed on the diaphragm area and connected in a resistance bridge. Thermal resistors 6 that act as temperature sensors

are located on inner mounting 2. The proposed design reduces the temperature effect of the chassis on the sensor. The outer mounting is used for holding the sensor in the chassis, and the inner frame protects the diaphragm region from mechanical stresses that arise during fastening. Experimental results are given on pressure sensors using these sensing elements. Figures 2; references 3: 2 Russian, 1 Western.
[6610-277]



USSR UDC 621.314.12

A CONTACTLESS D.C. CURRENT-TO-VOLTAGE INSTRUMENT CONVERTER

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 4, Jul-Aug 79 pp 137-140 manuscript received 16 Jan 78

[illegible], M. P., IVKIN, V. G., KAN, YU., MOZIN, I. V. and OBIDENKO, YU. S.

[Abstract] A d.c. current-to-voltage converter for precision measurement of constant or slowly varying high currents in electrophysical experiments has been built which is a contactless device. It operates by the principle of compensating the magnetic field intensity around a current conductor. Its main components include a second-harmonic magnetic modulation probe with an exciter, a scanning compensation current generator, a tuned amplifier, a phase shift compensator with an operational amplifier, a phase detector controlled by pulses from a frequency doubler, an amplitude detector and a comparator. Included is also a indicating instrument such as a digital voltmeter with an analog-to-digital converter. The probe is an annular ferromagnetic differential one sensitive to a circulating magnetic field, highly sensitive and reliable. The test model of this device has a 0-$\pm$2 kA input current range with a corresponding 0-$\pm$2 V output voltage range and main referred conversion error not exceeding $\pm 1 \cdot 10^{-5}$. Its nonlinearity is $\pm 3 \cdot 10^{-6}$ and its drift is maximum $\pm 4 \cdot 10^{-7}$ due to $\pm$10 percent fluctuations of the supply voltage, $\pm 2.8 \cdot 10^{-7}$ due to fluctuations of the ambient temperature over the 15-35°C range. The insulation between probe and current conductor can withstand 5 kV at least. Figures 4; references: 4 Russian.
[18-2415]

USSR UDC 621.317:511.15

LOGARITHMIC CURRENT CONVERTERS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 5, 1979 pp 35-36

SALIKHDZHANOVA, R.M.-F., candidate in technical sciences, and BRYKSIN, I. YE., engineer

[Abstract] A description is given of logarithmic current converters suitable for use in converting the current of instruments used in electrochemical investigations for plotting dynamic curves representing the dependence of the current of the working electrode of the electrochemical cell on the polarizing voltage into a signal proportional to the logarithm of this current. The curves plotted are as a rule represented in the form of the dependence of the logarithm of the current on the polarizing voltage, since the current of the working electrode can vary over a range of six to seven orders of magnitude in a single experiment with changes in the polarizing voltage of single numbers of volts. Logarithmic converters of the type described here contain two functional elements. The first element makes it possible to convert the input signal, varying over a wide range, into an output signal of restricted effective range. Switchable shunting resistors are used as this element when current is converted. The second element performs logarithmic conversion of the voltage entering the input. The employment of elements of the first functional group to restrict the range of the input signal makes it possible to use converters with high logarithmic conversion accuracy. As the converting element it is possible to use amplifiers in which the logarithmic characteristic is achieved by including nonlinear elements in a feedback circuit. Conversion accuracy can be improved considerably with a sufficient number of these elements in this kind of amplifier. The operating principle of these converters is explained. The converting element enables the required conversion accuracy with a change in input voltage from U_1 to U_2. If the signal in the converter's input proves to be greater than U_2 or less than U_1, then the shunting resistor is altered so that the voltage in the input of the converting element does not go beyond the range of $U_1 - U_2$. A disadvantage of this equipment has been sudden changes in voltage in the output of the logarithmic converter, occurring when the shunting resistor is switched, resulting in a break in continuity of the logarithmic characteristic. For the purpose of overcoming this shortcoming the type L1 and L2 logarithmic current converters, with manual and automatic switching of logarithmic conversion ranges, respectively, were developed. In these converters at the same time that the current measuring resistor is switched into the logarithmic amplifier's output a voltage is automatically supplied which is equal in magnitude and opposite in sign to the sudden change in voltage in the amplifier's output. The L1 is designed for six orders of magnitude of continuous conversion with a maximum current of 1A and the L2 for four and eight orders of magnitude with a maximum current of 10 A and an error in logarithmic conversion of current of one percent. A block diagram is shown of the

type L2 current converter. A comparison circuit and control circuit simultaneously automatically change the resistance of the current measuring resistor and supply to an adder the additional level of voltage of the appropriate sign from a controlled stepped voltage source. The circuit diagram of the L2 logarithmic converter is shown. It is possible to improve conversion accuracy by selection of the number of nonlinear feedback circuits. Six of these circuits are used in the L2. Figures 3; references 3: 2 Russian, 1 Western.

USSR UDC 621.317.725

AN INTEGRATING VOLTAGE-TO-TIME CONVERTER

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 4, Jul-Aug 79 pp 134-137 manuscript received 17 Feb 78

FROLOV, V. M. and ANDREYEV, A. B.

[Abstract] The feasibility of a high-precision high-speed voltage-to-time converter is examined and an integrating device of this class is described which converts 0-10 V voltages to time intervals for synchronous detection of rectangular signals with a duty factor of 2 submerged in high-frequency noise. It consists of a main integrator, an auxiliary integrator, a reset, a comparator, a clock pulse shaper, a reference-voltage generator and a 2-input trigger. Its maximum speed is determined on the basis of the fundamental steady-state performance equation, taking into account the response in consecutive cycles. An actual prototype device built with standard components including integrated microcircuits can track 0-10 V input voltages at the rate of 500 Hz with a referred error within 0.01 percent. Its temperature stability is within 0.02 percent/10°C over the 10-30°C range. Further improvement of these characteristics should be possible. Figures 2; references 5: 4 Russian, 1 Western.
[18-2415]

USSR UDC 621.317.791

PARTICULARS OF USING PRIMARY DATA CONVERTERS IN MULTICHANNEL MEASUREMENT SYSTEMS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 7, Jul 79, p 25

SHVETSKIY, B. I., doctor in technical sciences, ZELENTSOVA, N. I. and TARASOV, V. P., engineers

[Abstract] A brief analysis of peculiarities of magnetomodulation converters as the primary data transducers in systems for checking electron-beam devices for measuring signals in high-voltage and "floating" electric fields. The major requirements for this use of such converters are high-voltage insulation, electrical isolation of the input circuit, and shielding to reduce leakage currents. It is shown that the admissible phase shift of the output signals of a magnetomodulation converter depends on the admissible relative change in the image-transfer constants. Figures 2; references: 3 Russian.
[6610-277]

USSR UDC 681.325

PRINCIPLES OF DESIGNING BIPOLAR DIGITAL-TO-ANALOG CONVERTERS FOR POSITIONAL COUNTING SYSTEMS

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 2, Mar-Apr 79 pp 73-75 manuscript received 17 Feb 78; after completion, 10 Aug 78

SELIVANOV, VIKTOR L'VOVICH, candidate in technical sciences; BANYA, YEVGENIY NIKOLAYEVICH, candidate in technical science; and IVANOV, VIGLENTIY TROFIMOVICH, engineer, Kiev Polytechnic Institute

[Abstract] Binary-decimal codes are increasingly used, along with alternating binary codes, in digital control systems with bipolar decoders. The synthesis of a bipolar structure is based on mathematical simulation of its operation. Here the synthesis of a bipolar converter from a forward or backward code is shown, with either bias commutation or the use of complementary codes for representation of negative numbers. Figures 1; references: 3 Russian.
[15-2415]

USSR UDC: 681.325.5

A RADIATION CONVERTOR BASED ON A "PHOTO CONDUCTOR-ELECTROOPTICAL MATERIAL" STRUCTURE

Novosibirsk AVTOMETRIYA in Russian No 3, May/Jun 79 pp 98-101 manuscript received 22 Feb 78; in final version, 4 Jul 78

BILENKO. D. I.. DERBOVA. T.G.. LODGAUZ. V. A. and LYASKOVSKIY, I.I.,Saratov

[Abstract] Earlier radiation convertors based on a photo conductor and a material with induced birefringence have certain shortcomings: the need to cool the system to near the Curie point, and the great variation in electro-optical coefficients with slight variations in temperature. These shortcomings can be overcome by using plates of $LiNbO_3$ cut at an angle. This material has transparency over a broad spectral range, and does not require cooling or temperature stabilization. The device described uses a plate of $LiNbO_3$ about 250 μm in diameter, plus a plate of high-resistance cadmium sulphide. The contrast achieved by the convertor as a function of voltage for various power supply frequencies and excitation radiation densities is presented. Figures 4; references 3: 2 Russian, 1 Western. [2-6508]

USSR UDC 621.376.3.088.3

EFFECT OF NOISE ON A PERIOD SENSOR

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 5, 1979 pp 31-32

VETRYAK, V. I. and KNORRING, V. G., candidates in technical sciences

[Abstract] By analogy with digital frequency meters, which give a reading proportional to the integral of the measured frequency when measuring constant and slowly varying values, it would seem that period sensors with a linear relationship between the signal's period and the measured value could also be able to be used for the purpose of measuring integral values of varying magnitudes. However an experimental study of the noise rejection of a digital dynamometer revealed a systematic error in measuring the integral value of the force, which depended on the amplitude of the variable component. Although the relative nonlinearity of the sensor's characteristic was not greater than 0.2 percent in the working range, this error reached single numbers of percent. Here an analysis is presented which demonstrates that this error is observed even when using period sensors with an absolutely linear static characteristic. The analysis begins with the equation for the dependence of the result of measuring n periods of the output signal of a controlled clock on the input value. An equation is then given for the resulting reading on the assumption that it is a linear function of the input value. These equations are solved jointly to

obtain an expression for the frequency of the controlled clock. Harmonic noise is then superposed on the constant measured value. On the basis that the digital counter is the integrating element for the frequency of the reference clock and a discrete frequency divider determining the measuring interval of the digital period meter is the integrating element for the frequency of the controlled clock, the mean value of the measuring result is equal to the ratio of the integrals of these frequencies during the measuring interval. It is demonstrated that this mean value differs from the true. The relative averaging error is defined as the ratio of the difference of the measuring results in the presence of harmonic noise and without it to the absolute deviation in the reading under the effect of a constant input value. An equation is then derived for calculating the averaging error. It is shown that the result of measuring the physical value modulated by harmonic noise is lower than the true mean value. The averaging error depends chiefly on the amplitude of the noise. With a noise amplitude equal to the constant component of the input value and with a relative deviation in the output reading of 0.1, the averaging error equals 4.5 percent of the mean value of the measured magnitude. If the noise level is reduced twofold, then the error is reduced to 1.1 percent. If this error is detected either by calculation or experimentally, then for the purpose of eliminating it it is necessary to change from continuous integration to summing the results of measurements over time intervals which are shorter than the period of the noise. The same error can be found in analog measurements when the time constant of the smoothing filter is greater than the period of the noise at work in the sensor's input. References: 2 Russian.

USSR UDC 621.398.523

BINARY CODE TO BINARY CODE DECIMAL CODE CONVERTER

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 6, 1979 pp 32-33

ALTERSHMIT, YE. I., CHERNYAKOVSKIY, I. M. and CHEREPANTSEV, A. P., engineers

[Abstract] The Special Design Bureau of Microelectronics in Instrument Construction (SKB MP, Lvov) has developed a high-speed code converter of binary code into binary code decimal (BCD). The converter is used in a prototype of an automated control system for preparing mixtures for data display which arrives as binary code. The new device is faster than current models. The device operates as follows: a trigger pulse writes the parallel binary code in a register; information of three low-order bits is written directly in the BCD count of the low-order decimal bit. The rear front of the trigger pulse switches on the start trigger by putting out an enabling

signal. The clock pulse generator triggers the BCD count. The decoder, count and OR-gate form the code-to-pulse count converter. The decoder specifies all nine counter states in succession. A 12-binary digit converter is made in the form of a cassette 215 x 120 on a printed circuit board with K133 ICs. This converter may be used in digital measuring devices and systems as a final function assembly. This method of conversion can be recommended for use in code-frequency, code-time and other converters. Figures 1; references: 2 Russian.
[241-8617]

USSR UDC 681.325.3

ANALOG-CODE CONVERTER

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 6, 1979 p 34

OLIFERENKOV, V. G. and POTASHNIK, M. M., engineers

[Abstract] To tackle problems related to the measurement of non-electrical quantities when using computers, output signals of analog sensors must be converted into digital codes. The conversion problems can become complicated as a result of increasing accuracy requirements and requirements imposed on the shape of the characteristic curve of the converter. An example of this is the analysis of flow density of a finished product from a reservoir. Flowing density is computed on the basis of the rated density of the product (adjusted to 20°C), flow temperature and temperature correction of density. The temperature is measured by a resistance thermometer with subsequent conversion of resistance into current; thereafter current is converted into a code by the analog-code converter. Figures 1.
[241-8617]

USSR UDC 681.325.22

CODE CONVERTERS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 6, 1979 pp 33-34

IVANOV, V. I., candidate in Physicomathematical Sciences, STANCHITS, I. S., and GAREYEV, R. M., engineers

[Abstract] Code converters are used in measurement technology to transmit output information from digital meters to digital printers (TsPU). The

A95KM digital printer is designed to print information put out by digital meters (e.g., voltmeters, digital bridges). It can print information arriving from several digital sources, but only those which operate in one of the binary code decimal (BCD) codes with the weight 8-4-2-1; 2*-4-2-1; 2**-4-2-1 or 2***4-2-1. Code converters were designed to support data output to one TsPU from devices which put out information in BCD with weights listed above; they are memory trigger-relay cells whose logical functions are implemented using relay contacts. The trigger relay cells are designed to receive information from the output of digital devices and store it for one measurement period. They consist of triggers with discrete inputs, a composite transistor and RES-22 type relay. The trigger is controlled by "Set 0" pulses and pulses from the digital meters no wider than 2 microseconds and amplitude of 9 volts. If the devices have potential outputs, they are connected directly to the transistor base across a resistor which limits base current. The use of code converters expands the possibilities of automation of measurements in various experimental, research, and technological monitoring installations, guaranteeing recording of the readings of digital meters putting out information in different codes on a single digital printer. Figures 3; references: 3 Russian.
[241-8617]

USSR UDC 781.142.621

TWO-CHANNEL 10-PLACE ANALOG-DIGITAL CONVERTER

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 5, 1979 pp 36-37

BACHERVICH, N. P., doctor in technical sciences; BRYAKIN, L. A., and DVORKOV, V. F., engineers

[Abstract] A description is given of a method of creating a self-correcting multistage analog-digital converter with a number of places in each stage of from two to four. The disadvantage of a multistage analog-digital converter is its low accuracy resulting from the accumulation of a conversion error in the process of transmitting information from stage to stage. The more stages there are, the greater the conversion error, while on the other hand attempts to reduce the number of stages result in much larger equipment with the same number of places. The solution offered here represents a compromise and features a minimum amount of additional equipment with sufficient accuracy and speed of response of correcting circuits. A stage consists of comparators, a decoder, current sources, correcting circuits, a unit for fixing analog values, and reference voltage sources whose values can be modified over a specific range. Total correction of a stage is performed in four cycles, whereby to the input of a stage are fed four reference voltages, by which the following parameters are corrected: the disbalance between comparators, the accuracy in assignment of

reference voltage source levels, the accuracy in setting values of the current sources, the degree of the zero drift of the fixing unit, the stability of the voltage transmission coefficient of the fixing unit, and the value of the bias voltage of the fixing unit when changing to the hold mode, brought about by the influence of control circuit signals. All these parameters influence the accuracy of coding of a signal by a stage. During each correction cycle the fixing unit of the preceding stage is in the hold mode and the fixing unit of the stage being corrected is in the slave mode. In the first cycle the zero of the fixing unit is corrected and in the second the first reference voltage source is corrected by means of the first comparator and the first current source is corrected by means of the fixing unit and the first correcting circuit. In the third cycle the second reference voltage source and the second current source are corrected, and in the fourth the third reference voltage source. The reference voltages according to which correction takes place are supplied to the input of the analog-digital converter. Stages are corrected in sequence, starting with the first. The voltage transmission coefficient of the fixing unit and the zero drift voltage when the fixing unit changes to the hold mode are corrected without the addition of special circuits because of the algorithm employed. For correcting the 10-place multistage analog-digital converter shown here 16 correction cycles are required, meaning that 16 reference voltage levels are supplied, evenly distributed over the entire scale of the converter's input voltage. An external digital-analog converter can be used as the reference voltage source. A block diagram is shown of a two-channel multistage analog-digital converter created by the authors. This converter functions in three modes, including independent operation of each channel, joint operation, and a correction mode in which both channels are corrected simultaneously. The reference voltage source is a 2PD524 microcircuit. Correction is performed by the analog method with storage of the result in a capacitor. The correcting circuits are in the form of two-way current switches controlled by digital signals from series 155 microcircuits. Used as current switches are 1KT902 microcircuits, which make it possible to make a correction at a frequency of not greater than 2 kHz. The length of each correction cycle is 10 μs. It is possible to reduce the instrument error of this and other analog-digital converters by using more accurate reference voltage sources. An experimental model has been made of the two-channel 10-place multistage analog-digital converter described here. It utilizes series produced elements and 10 precision resistors. Figures 4; bibliography 3: 2 Russian, 1 Western.

USSR UDC 621.374.5

DISTORTION OF NANOSECOND MICROWAVE PULSES IN A SUPERCONDUCTING CABLE

Kiev IZV.VUZ: RADIOELEKTRONIKA in Russian Vol 22, No 7, Jul 79 pp 68-70
manuscript received 19 Apr 78; after revision, 31 Jul 78

SHIYAN, V. P.

[Abstract] An examination is made of pulse distortions of signals in a superconductive coaxial cable as dependent on the propagation constant, the transient response and the pulse characteristic of the line. An estimate is made of distortions in such a cable for a nanosecond bell-shaped pulse. A spectral method of analysis is used to find an expression for the output pulse. An analysis of this expression shows that the output pulse is also bell-shaped but has a lower amplitude and slope than the input signal. Expressions for the change in duration of the output signal and deviation of the carrier frequency show that as damping increases with frequency there is a reduction in the carrier frequency and an increase in duration of the pulse. Comparison shows that the input and output spectra are nearly the same for a bell-shaped microwave pulse transmitted through a superconductive cable. An experiment shows that the microwave pulse amplitude is changed by only about 13 percent with passage through a superconductive cable 100 m long with no noticeable change in duration at half height. Figures 3; references 6: 5 Russian, 1 Western.
[6610-268]

USSR UDC 389.531.788

MAGNETRON DISCHARGER CELLS WITH A PERIODICALLY NONUNIFORM MAGNETIC FIELD

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 4, Jul-Aug 79 pp 202-204 manuscript received 27 Mar 78

PAKULIN, V. N., Institute of Agrophysics, Leningrad

[Abstract] Two versions of an open Penning discharger have been built with an electric field orthogonally crossing a periodically very nonuniform magnetic field in the space between two coaxial cylindrical electrodes. The cathode is always a cylindrical cup made of Kh18N10T stainless steel, with the anode made of the same material either as a mesh around the cup in the regular version or as a pin inside the cup in the inverted version. In the former case disk magnets with small center holes are made of a Sm-Co alloy and stacked on a pin inside the cup facing one another with like poles, separated by spacers. In the latter case disk magnets with large center holes are made of barium ferrite and stacked around the cup facing one another with like poles, separated by spacers. The spacers are in both cases made of a magnetically soft material such as Armco iron. The discharge current is proportional to the air pressure, with the ratio [illegible] (A/V)(torr) approaching 1. The regular version, with the magnets inside the cathode and the anode outside the cathode, is more suitable for use as a manometer. The inverted version, with the anode inside the cathode and the magnets outside the cathode, is more suitable for use as a high-speed pump with an approximately 10 times higher discharge current and thus suction rate attainable. Both have been tested with a 2000 V and with a 600 V supply voltage. Figures 3; references 3: 2 Russian, 1 Western. [18-2415]

UDC 537.226.001.57

A STATISTICAL MODEL OF BREAKDOWN IN DIELECTRICS WITH WEAK SEGMENTS

Moscow ELEKTRICHESTVO in Russian No 7, Jul 79, pp 21-25 manuscript received 25 Jan 79

[illegible]MEZHIRKOV, B. R. and MARITONOV, YE. V., Leningrad

[Abstract] A statistical model of breakdown in dielectrics is proposed which includes a weakest link and where the distribution function of the breakdown voltage remains invariant with respect to geometrical scaling of the insulator surface. Such a distribution function is $F_S(V) = 1 - \exp[-\lambda S(V/V_0)^{\alpha}]$ $(0 < V \leq V_0)$ with λ and V_0 being [illegible] and with S denoting

the surface area. Furthermore, $F_S(V) = 0$ for $V \leq 0$ and $F_S(V) = 1$ for $V > V_0$. This model is applied to an insulator with a random distribution of local defects over its surface touching an electrode, defects for which $V_{bd} < V$ and their distribution shown to be subject to Poisson statistics. The monotonically increasing function $\phi(V)$ in the exponent can be either an exponential function too or a power function. The model is successively generalized to cover dielectrics with two or more different types of defects responsible for breakdown, with different types of defects critical within different voltage ranges, and finally dielectrics subject to multiple consecutive breakdowns. These generalization are reflected in the $\phi(V)$ function, i.e., its appearance in the form of a sum of terms with different coefficients or in the form of a second-degree binomial and eventually by replacement of the exponential term altogether by an integral according to the Laplace approximation. Figures 6; references 6: 4 Russian, 2 Western.
[285-2415]

USSR UDC 537.533.32

DESIGN OF AN ANNULAR ELECTRON GUN

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 4, Jul-Aug 79 pp 196-198 manuscript received 23 Mar 78

PRUDKOVSKIY, G. P. and KHOTINA, A. V., Institute of Physical Problems, USSR Academy of Sciences, Moscow

[Abstract] An annular electron gun has been designed with the aid of an analog computer and a trajectograph. The motion of electrons in a rotating meridional plane was analyzed and their azimuthal velocity was calculated, as a basis for optimizing the geometry of the electron-optical system. The gun features centrifugal focusing, which eliminates the effect of space charge and ensures beam stability. The beam can be compressed from a large annular emitter toward the axis and, upon reflection, become parallel. The emitter is effectively protected against ion bombardment and against radiation, also against metal vapor or splashes of molten metal in a metallurgical plant. The effect of extraneous steel objects on the magnetic field distribution in the gun was also taken into account. Figures 1; references: 7 Russian.
[18-2415]

USSR UDC 537.533.32

CONSTRUCTION AND TESTING OF AN ANNULAR ELECTRON GUN

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 4, Jul-Aug 79 pp 199-202 manuscript received 23 Mar 78

POLINOVSKIY, V. A., PRUDKOVSKIY, G. P. and KHOTINA, A. V., Institute of Physical Problems, USSR Academy of Sciences, Moscow; All-Union Scientific Research, Design Planning and Technological Institute of Electrothermal Equipment, Moscow

[Abstract] A magnetron-centrifugal electron gun of up to 100 kW power has been built for metallurgical melting furnaces. The electrodes are annular in shape: the copper anode and the copper cathode, both water cooled, also the reflector connected to the cathode for covering the acceleration space, and the emitter. The gun is designed for an anode voltage of 10-30 kV, which it receives from a current rectifier-stabilizer. The electron beam has been shaped for optimum performance. The current-voltage characteristics of the gun and the current distributions in the electrodes were measured during a long melting test at a power level of 90 kW. The width of the heating zone could vary from 40 to 120 mm. Figures 5; references: 2 Russian.
[2-2412]

USSR UDC 621.313-213.3:53.093

BASIC PATTERNS OF MOISTURE EXCHANGE IN ENCLOSED ELECTRICAL EQUIPMENT

Moscow ELEKTROTEKHNIKA in Russian No 7, Jul 79 pp 22-24 manuscript received 5 Apr 78

SHAKULA, N. M., candidate of technical sciences

[Abstract] An examination is made of the major principles governing moisture exchange in enclosed electrical equipment based on the example of explosion-proof motors. Research has shown that the principal reasons for moisture exchange are due to water that gets into the casing, exchange of air in the free volume of the motor with the ambient atmosphere due to blowers, and "breathing." Moisture exchange may also take place due to other factors such as diffusion and a change of air temperature and pressure in mine operation. Reliability studies have shown that penetration of water droplets into the casing is not unusual, and consequently steps should be taken during design to provide better protection from the ambient medium. In motors with forced interchange of air, breathing ports should be provided

with filters. A detailed analysis is made of factors that determine the possibility of phase transitions with "breathing." It is concluded that humid air in the shell of enclosed electrical equipment must be considered as a mixture of dry air and water vapor rather than as an ideal gas. In some cases, it may be necessary to provide air conditioning since there is as yet no universal method of climatic protection of enclosed equipment. Figures 2; references 8: 4 Russian, 1 Polish, 3 Western.
[6610-278]

USSR UDC 621.313.222

A D.C. SERIES MOTOR AS A SERVOMECHANISM COMPONENT

Moscow ELEKTRICHESTVO in Russian No 7, Jul 79 pp 65-66 manuscript received 26 Oct 77

SHCHEGLOV, A. F., candidate in technical sciences, Moscow

[Abstract] The performance of a d.c. series motor as a component of a position servo is analyzed, taking into account not only inertia and friction as well as the electrical circuit parameters but also significant characteristics of other system components. These include the load, an angular-position data transmitter, an amplifier, a tachometer generator and a gear train. The system is described by three nonlinear differential equations which, after being linearized according to the perturbation method, reduce to a fourth-degree characteristic algebraic equation and from there the open-loop and the closed-loop transfer functions. Now the stability limits and the optimum transient for the oscillatory element can be determined. This procedure applies only when the transmitter runs at a constant speed and the linearization is valid. Figures 4; references: 3 Russian.
[284-2419]

USSR UDC [621.313.323:62.58].001.8

LOW-SPEED GEARED MOTORS

Moscow ELEKTROTEKHNIKA in Russian No 7, Jul 79 pp 20-21

KURAKIN, A. S., doctor in technical sciences, professor, MALYSHEV, A. D., candidate in technical sciences, and MALYSHEVA, G. M., engineer

[Abstract] A motor design is proposed for providing an output shaft speed of less than 60 rpm. A distinguishing feature of the motor is that there are two air gaps with bilateral serrations (double electromagnetic gearing). Expressions are given for the specific permeances in the air gaps. Both active and reactive rotors are considered, and it is shown that lower limits of 0.5-1 rpm are feasible for synchronous motors running on industrial frequency with an active rotor, and 1-2 rpm can be attained with a reactive rotor. Figures 2; tables 2; references: 1 Russian.
[6610-278]

USSR UDC 621.313.333.001.2(049.3)

DEVELOPMENT OF HIGH-ECONOMY AND RELIABLE SERIES OF ELECTRIC MOTORS

Moscow ELEKTROTEKHNIKA in Russian No 7, Jul 79 p 47

KOPYLOV, I. P., doctor in technical sciences, Professor

[Abstract] A brief review of the book "Proyektirovaniye seriy elektricheskikh mashin" [Designing Series of Electric Machines] by Ya. S. Gurin and V. V. Kuznetsov, published by "Energiya" in Moscow, 1978. Extensive material is generalized on development of the Soviet series of induction motors A, A2 and 4A, and DC motors P and 2P. Chapter 1 reviews the stages and provides basic data on development of electric motor design in the USSR. Chapters II-V present the requirements of modern standards for power scales, dimensions, design modifications for degree of shielding, cooling method and mounting, climate and mechanical factors, as well as the basic working characteristics of motors. Chapter VI examines the general structure of modifications of motor series and the main engineering requirements for these modifications. Chapter VII gives information on electrical and structural materials used in designing a series of motors. Chapter VIII considers economic substantiation of versions of motors being designed. Chapter IX deals with equipment and techniques for making motors. In Chapter X, an examination is made of problems of improving the reliability of motor designs. Chapters XI and XII deal with laws of increase in outside diameters, powers, lengths of cores and the relations between them, and examine questions of standardization. Chapter XIII is devoted to the use of computers in motor design. Chapters XIV-XIX cover methods of electromagnetic calculation.
[6610-278]

USSR UDC 621.314

A HIGH-VOLTAGE POWER PULSE TRANSFORMER

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 4, Jul-Aug 79 pp 164-167 manuscript received 20 Mar 78

VDOVIN, S. S., Dnepropetrovsk State University

[Abstract] A transformer is shown which delivers nearly rectangular pulses to a particle accelerator at voltage levels not attainable from conventional thyratrons directly. It includes a toroidal core and a secondary winding of four coils connected in parallel. Calculations based on circuit parameters and relations, according to appropriate formulas, indicate the feasibility of generating 10 GW pulse with a small distortion, 1 MV with only a 14.3 percent risetime and 100 kV with only a 0.46 percent risetime referred to the pulse duration of 1-10 μs. Figures 1; tables 1; references: 1 Russian.
[18-2415]

USSR UDC 621.315.61.002.25

CALCULATING THE LIFE OF HIGH-VOLTAGE INSULATION SUBJECT TO SEVERAL AGING FACTORS

Moscow ELEKTRICHESTVO in Russian No 7, Jul 79 pp 25-28 manuscript received 2 Aug 78

KULAKOVSKIY, V. B. and SAMORODOV, YU. N., All-Union Scientific Research Institute of Electrical Engineering

[Abstract] A method of calculating the life of high-voltage insulation subject to several aging factors simultaneously is proposed, these aging factors assumed to remain constant throughout the test period. The basis of this method is the kinetic theory of dielectric strength. It recognizes that the dielectric strength decreases at a rate which increases rather than remains constant with time. It also assumes, however, that the effect of all aging factors on the decrement of dielectric strength is additive. The formula $E_t = (1 - t/T)^{1/n}$, with T denoting the hypothetical time after which the dielectric strength E_t becomes zero, is universal inasmuch as it applies to electrical as well as mechanical and thermal aging factors. Compounding of the theoretical life under several aging factors yields for two factors $(1 - T_{\Sigma}/T_1)^{1/n_1} + (1 - T_{\Sigma}/T_2)^{1/n_2} = 1$ and thus

$T_{\Sigma} = \frac{T_1 T_2}{T_1 + T_2}$. Calculations based on this formula for a "monolithic" insulation both under an alternating mechanical load of constant amplitude and under a constant electric field intensity agree closely with experimental data for each load separately and both loads acting simultaneously. Figures 2; tables 1; references 4: 3 Russian, 1 Western.
[285-2415]

UDC 621.316.022.001.2

ANALYSIS OF SUPERHIGH-CURRENT SWITCHING THROUGH A MOVING LIQUID-METAL LAYER

Moscow ELEKTRICHESTVO in Russian, No 7, Jul 79 pp 62-64 manuscript received 2 Mar 79

GUTAPENKO, R. I., candidate in technical sciences, SHUGALEY, A. M., Krasnoyarsk

[Abstract] Moving liquid-metal commutators are being developed for switching superhigh currents of the order of 10^5 A in low-voltage equipment for electrolysis and electrothermy. The design of such commutators must take into account several factors affecting their performance, one of them being thermal shock. This problem is analyzed here for a mercury column between a central electrode and an outer sleeve electrode. The temperature transient and the maximum temperature are calculated on the basis of equivalent electrical circuit parameters and convective heat transfer during quasi-steady turbulent flow with evaporation according to the relation $N_{Nu} = 10 + 0.019\,N_{Pe}^{0.8}$. These calculations, based on the differential equation of heat balance, indicate that the maximum excess temperature above that of the liquid metal decreases hyperbolically with increasing velocity of the liquid-metal column. They also indicate at what rate of making contact will the liquid metal cease to boil. Figures 3; references 4: 3 Russian, 1 Western.
[285-2415]

USSR UDC 621.316.98.001.4

ESTIMATION OF THE RELIABILITY AND THE TEST CONDITIONS WITH REGARD TO AIRCRAFT LIGHTNING PROTECTION

Moscow ELEKTRICHESTVO in Russian No 7, Jul 79 pp 72-73 manuscript received 26 Feb 79

AGAPOV, V. G., candidate in technical sciences, LARIONOV, V. P., doctor in technical sciences, SERGIYEVSKAYA, I. M., engineer, Moscow Power Engineering Institute

[Abstract] Lightning protection of vulnerable aircraft components is necessary, but it enlarges the overall mass and complicates the assembly. It can also detrimentally affect the performance characteristics of airborne equipment such as a dielectric fairing. Thus a tradeoff between safety and performance must be found. Here this tradeoff is established on the basis of a strike probability analysis. The results indicate the feasibility of testing the protective devices separately with pulse and constant components of the lightning current, as well as the necessity of testing an aircraft model for selective vulnerability. Tables 1; references 3: 1 German, 2 Western.
[285-2415]

USSR UDC 621.384.603.06

A HIGH-VOLTAGE SUPPLY SYSTEM FOR AN ELECTROSTATIC DEFLECTOR

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 4, Jul-Aug 79 pp 189-193 manuscript received 9 Mar 78; after modification 18 Oct 78

AKKURATOV, V. A., GLAZOV, A. A., KUDRYASHOV, V. V., SEMENOV, M. M., SHAKUN, N. G. and YUN HO ZIN, Joint Institute of Nuclear Research, Dubna

[Abstract] Electrostatic deflectors for particle extraction from a cyclic accelerators require a stabilized voltage up to 100 kV at a maximum load current of 1 mA. Such a supply has been built which is essentially a 6-phase controlled rectifier. It includes a multiplier column of 20 2Ts106G diodes stacked with 10 K15-4 (2200 pF) capacitors, a converter on KT906A transistors operating in the saturation mode, a 1:200 step-up transformer with an open ferrite core and with high-frequency compensation to suppress resonance between stray capacitance and leakage inductance, and thyristors. The latter are stabilized by feedback from the high-voltage end through a voltage divider to a P210A regulating transistor with a K1UT401B integrated-circuit d.c. amplifier, their firing angle being controlled by a d.c.

amplifier with an MP38A transistor loaded by an MP25B transistor switch in the collector circuit. The output voltage can thus be smoothly regulated over a wide range from 10 to 100 kV. The converter excitation comes from a master multivibrator through a 3-stage amplifier. Current protection is also provided. This design ensures a higher efficiency and a smaller size than a comparable vacuum-tube voltage supply, with a voltage stability within 10^{-3}. Figures 4; references 3: 2 Russian, 1 Western.
[18-2415]

USSR UDC 621.385.832.7.032.269

A 4-ELECTRODE ELECTRON GUN EMITTING A BEAM OF 10x80 cm^2 CROSS SECTION INTO THE ATMOSPHERE

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 4, Jul-Aug 79 pp 194-196 manuscript received 21 Feb 78

SHUR'YEV, YU. V. and CHANTURIN, L. P., All-Union Institute of Electrical Engineering, Moscow

[Abstract] An electron gun for beams of large cross section and with controllable current density distribution has been built which consists of four electrodes inside a vacuum chamber. The chamber of rectangular cross section is made of stainless steel. The electron beam coming from an array of five heated cathodes passes a plane variable-potential shaping electrode which can produce an almost uniform current density at the first anode, except around the beam edges, is then accelerated behind the first anode by a plane-parallel electric field and reaches the pedestal grid with an aluminum-foil window through which it is emitted into the atmosphere. The performance of this electron gun was measured with a segmental movable collector. Beams of 10x80 cm^2 cross section with an electron energy of 130-150 kev are attainable having a current density up to 4 mA/cm^2 in 250 μs pulses at a repetition rate of 100 Hz and up to 100 $\mu A/cm^2$ continuously, uniform within 10 percent. Figures 3; references 4: 2 Russian, 2 Western.
[18-2415]

USSR UDC 621.396

AUTOMATION OF EXPERIMENTAL STUDIES FOR THE SOLUTION OF ONE CLASS OF IDENTIFICATION PROBLEMS

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 2, Mar-Apr 79 pp 86-90 manuscript received 1 Dec 77; after completion, 2 Dec 78

SKURIKHIN, VLADIMIR IL'ICH, academician (Academy of Sciences of the Ukrainian SSR); URSAT'YEV, ALEKSEY ANDREYEVICH, candidate in technical sciences, MAKAROV, GENRYKH TIMOFEYEVICH, candidate in technical sciences, both of Institute of Cybernetics, Ukrainian SSR Academy of Sciences, Kiev

[Abstract] A system for automation of experimental studies involving the construction of stochastic models of objects with incomplete information, has been built earlier for the welding industry by the Institute of Cybernetics jointly with the Institute of Electric Welding imeni Ye. O. Paton. It consists essentially of one subsystem with special-purpose data collecting and recording equipment, and a data processing system based on a general-purpose computer. This system must now be further improved by introduction of a special-purpose minicomputer for checking and correcting analytical models on the basis of laboratory and factory tests, specifically applicable to the large class of objects mathematically describable by the model

$$y = \sum_{i=1}^{k} \Theta_i f_i(x) + \xi$$

where y and x are the algebraically (not probabilistically) dependent variable (response) and independent variable, $\{\Theta\}_{i=1}^{k}$ are the model parameters, $f_i(x)$ are generally a priori known functions, and ξ is the random error of response measurement. The model parameters are best estimated by the method of least squares. A complete regression analysis is possible on the basis of a normal distribution of the random error. The computer system is a hybrid one, including an analog preprocessor with encoders-decoders and a synchronizer, a microprocessor with controls and a direct-access memory, also peripheral equipment. Adding a read-only memory will reduce the size of the direct-access memory and, at the same time, simplify the computer operation. Figures 1; references 12: 10 Russian, 2 Western.
[13-2415]

USSR

UDC: 621.472:537.311.33

SEMICONDUCTOR SOLAR BATTERIES ON EARTH

Novosibirsk AVTOMETRIYA in Russian No 3, May/Jun 79 pp 110-116 manuscript received 18 Jan 78

BATSKEVICH, V. M. and SMIRNOV, L. S., Moscow-Novosibirsk

[Abstract] This work is a brief summary of a report read at the Inter-Institute Seminar on Problems of Contemporary Optics and Spectroscopy, concerning direct utilization of natural sunlight for human needs. The article is written in popular style and briefly describes the capabilities of solar semiconductor convertors for transformation of sunlight into electricity. It is pointed out that the very areas with the greatest number of sunny days per year are frequently those which are relatively sparsely populated, so that it is both difficult and expensive to import fuel or electricity for the power needs of the local population. In these areas, direct conversion of sunlight will first be economically expedient. References: 9 Russian.
[2-6508]

USSR

UDC 621.[illegible]

A [illegible] CAPACITOR BANK WITH A SHORT TIME CONSTANT

[illegible] I TEKHNIKA EKSPERIMENTA in Russian No 4, Jul-Aug 79 pp 167-170 manuscript received 25 Jan 78

[illegible]EV, V. A., LITOVCHENKO, V. K., PROKOPENKO, V. F. and MAKEYEV, G. M.

[Abstract] A [illegible] μF - 50 kV capacitor bank for storing 1.1 MJ of energy [illegible] in 12 modules, each divided into 4 sections of 6 IM-50/3 [illegible], with a commutating solid-dielectric discharger. The latter is [illegible] by an auxiliary discharger including a spark-discharge thyratron [illegible] (IM-50/3) capacitors in an asymmetric configuration with a 0.5±0.1 μs [illegible]. The bank and the discharger have low stray inductances, 4 and [illegible], the natural period is 12 μs and the short-circuit current [illegible] MA. The equipment is easy to operate and has a life expectancy [illegible] of switching 1 MA per module at 50 kV. The polyethylene [illegible] very strong and current leakage is negligible. Figures 5; [illegible] Russian, 1 Western.
[illegible]]

UDC 621.372.061.2

MODERN TRENDS IN THE DEVELOPMENT OF THE THEORY OF LINEAR ELECTRIC CIRCUITS

Moscow ELEKTROSVYAZ' in Russian No 7, Jul 79 pp 42-47 manuscript received 20 Sep 78

KNAMENSKIY, A. YE.

[Abstract] A history of the development of the theory of electric circuits is briefly presented. Current trends are outlined, including precision methods of synthesis of circuits, the design of amplitude-frequency characteristic correctors, amplifiers and AGC circuits. Electric circuits with distributed parameters are briefly discussed, and methods of determining their substitution circuits are analyzed. The use of active circuits and semiconductor electronics has been stimulated by the application of digital computers to the theory of electric circuits. The basic trends for the future in the development of the theory of electric circuits include: development of methods for optimal planning of electric circuits; development of methods for manufacture of devices performing analog functions but made with digital equipment; broader utilization of computers; and the use of the methods of the theory of circuits for the development of systems theory. Figures 4; references: 23 Russian.
[774-6508]

UDC 621.376.9

HIGH-STABILITY MULTIVIBRATORS BUILT WITH TRANSISTOR-TRANSISTOR-LOGIC INTEGRATED MICROCIRCUITS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 4, Jul-Aug 79 pp 141-143 manuscript received 3 Feb 78

VIDENKOV, V. I. and LYKOV, P. G., Moscow Power Engineering Institute,

[Abstract] Multivibrators with TTL integrated microcircuits have been built which feature an instability much lower than heretofore due to fluctuations of supply voltage and ambient temperature. This is achieved by addition of negative feedback through a resistive voltage divider around the M_{1-2} output stage of a driven multivibrator or around the two M_{1-2} and M_{3-4} output stages of an astable multivibrator respectively, which stabilizes the length of the discharge time and thus the pulse duration. Test results indicate negligible variation of the pulse width over the 5±0.5 V range of supply voltage and the 20-60°C range of temperature. Figures 3; references: 3 Russian.
[774-6508]

USSR

UDC 621.38:776

EXPERIENCE IN THE INTRODUCTION OF NEW MATERIALS FOR MAKING PRINTED CIRCUIT STENCILS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 7, Jul 79 pp 35-36

BABYAK, Z. V., RYABININ, A. A. and VASINA, R. P., engineers

[Abstract] An examination is made of new materials for making printed circuit stencils and techniques for production, based on the results of introduction in instrument making plants. These materials include mylar-based KPT-1 copy material, FST light-sensitive material and Fotoset-Zh photopolymer composite. The copy material for stencils is a mylar backing with a cement layer to which a sensitized emulsion is applied that is based on polyvinyl alcohol, gelatin and triethylene glycol plasticizer. This material can be used for transferring copies to the grid layout with minimum pressure, reduced deformation of circuit elements and preparation of printed circuit forms with resolution of 0.3 mm. However, the copy material is not industrially made because of production limitations. FST light-sensitive material is a solution of photopolymerized composite in ethyl alcohol. The photopolymer layer of the stencil has high mechanical strength, good adhesion to the grid, high flexibility and can reproduce [illegible] μm wide. However, the composition is not adequately resistant [illegible], stencil making is rather tedious, and therefore the material is not widely used. Fotoset-Zh is a system that contains a polymerizable oligomer, a polymerization initiator, a stabilizer and a solvent. Printed circuit forms are made directly with squeegee application of Fotoset-Zh. Exposure time is 10-15 minutes and development is in ethyl alcohol for no more than 5 minutes. The photopolymer layer has a resolution of 40 [illegible] per cm. The guaranteed number of offsets is 5000 without loss of the linear dimensions of the image. The annual savings from introducing the material should be 346,000 rubles. Experimental tests have shown that [illegible] is the most suitable of Soviet materials for making printed circuit [illegible]. References: 6 Russian.
[Publication]

UDC 621.38:776

[illegible] PRODUCTION FACILITY

[illegible] SISTEMY UPRAVLENIYA in Russian No 7, Jul 79 pp 36-37

[illegible], V. R., BLINOV, S. M., FROLOV, I. YA. and SELIVANOV, S. A.,

[Abstract] The paper describes the U896 exposure facility used in printed circuit production. This new unit uses LUF-80-04 fluorescent tubes that produce luminous flux saturated with ultraviolet rays in the 350-400 nm wavelength region, where currently used acid resists are most sensitive. The stencils and resist-treated circuit boards are clamped between transparent plates in a special frame and placed in the exposure facility. Vacuum registration is used to keep the stencils and board in tight contact. Exposure is done simultaneously on both sides of the frame. Exposure time is set by an automatic relay with a range of 15-540 s. A light meter monitors the uniformity of illumination, and automatically deactivates the facility if a light fails. The device holds two loaded frames with working surface of 1100x500 mm each. Figures 3.
[6630-257]

USSR

INFRARED TECHNOLOGY IN EVERYDAY USE

Moscow RADIO in Russian No 7, Jul 79 pp 45-46

IVANOV, B.

[Abstract] A brief survey of non-Soviet materials on the use of the infrared wave band in consumer goods. An elementary explanation is given of the operation of infrared emitters and receivers, and the advantages of these wavelengths over radio waves are explained. Some of the problems of data transmission in the infrared band are considered. Specific applications of infrared data transmission for the audio part of television signals and for stereophonic broadcasting are considered. Figures 3; references: 1 western.
[270-6610]

UDC 531.71.087.92:621.318.56

A SEALED-CONTACT MAGNETIC SENSOR OF DISPLACEMENTS OF AN OBJECT

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 7, Jul 79 pp 18-20

KHVOSTOV, A. P., candidate in technical sciences, LELYUKH, N. S. and KRESTEV, V. K., engineers

[Abstract] A sealed-contact magnetic sensor is proposed for measuring the magnitude and direction of displacement of an object. The working principle is based on the use of two sensing elements that generate signals on the displacement of the object in a definite sequence. As the object moves, it actuates the first element, which remains in the energized state until the second element is actuated. Then the signal is cut off in the first element and subsequently in the second element. To carry out this sequence the proposed pickup consists of a permanent magnet fastened to the moving object and two stationary sealed contact assemblies. Calculations are presented for determining the necessary distance between the sealed contact assemblies and the field strength of the permanent magnet. A numerical example is given. Figures 3; references: 3 Russian.
[6610-277]

A FOIL SENSOR FOR MEASURING THE PARAMETERS OF CRACKS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 7, Jul 79 pp 16-18

BAZHIN, YU. M., candidate in technical sciences, GALKINA, G. Z., GORDEYEVA, P. A., GRIGOVSKAYA, A. F. and KORCHAGIN, V. N., engineers

[Abstract] A brief description is given of foil crack propagation sensors now in use. Among the disadvantages of these sensors are nonlinearity of the output signal, inverse proportional relation between the number of filaments and the change in resistance when they break, and difficulties with the measurement process when the change in resistance becomes very small with a large number of filaments. The Design and Scientific Research Institute of Testing Equipment, Instruments and Facilities for Mass Measurement in Moscow has proposed a new design for such pickups that eliminates these disadvantages. In this sensor, the filaments of the sensing grid are shunted by resistors. As the filaments are broken, the difference in resistance increases linearly by steps equal to twice the value of the shunting resistance. The difference in resistance is independent of the number of filaments, and may be varied over a wide range. Test results show that these sensors can be used for measuring the length and rate of propagation of cracks in various kinds of fatigue studies. Figures 4; references 4: 3 Russian, 1 Western.
[6610-2174]

UDC 539.1.074

AN ELECTRONIC INSTRUMENT ON THE BASIS OF THE SPECIAL-PURPOSE KAMAK[illegible] INTEGRATED CIRCUIT FOR RECORDING THE SIGNALS FROM A PROPORTIONAL CHAMBER

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 4, Jul-Aug 79 pp 100-[illegible]
Manuscript received 8 Jun 78

[illegible], G. G. and TURIN, V. A., Joint Institute of Nuclear Research, Dubna

[Abstract] An electronic unit has been built with special-purpose [illegible] integrated circuits for recording the signals from proportional chambers. The module placed on a chamber consists of 16-printed-circuit boards with 16 channels each and thus picks up 256 signals, also a time-scanning board, and a buffer board through which and a data readout [illegible] in connection made to a CAMAC receiver. The channels are paired, two [illegible] integrated circuits, each having a complete amplifier-discriminator-[illegible]-memory structure. Use is made of OR logic in recording, ECL components are [illegible] on the coding-scanning board and TTL components are

mounted on the coding-scanning board and TTL components are mounted on the buffer board at the receiver input. The instrument has been tested in operation with a Ru^{106} electron source in an experimental one-coordinate chamber having the cathodic wall made of aluminized polyethylene terephthalate and containing a 75 percent Ar+ 23.5 percent CO_2 + 1.5 percent C_2H_5OH gas mixture. The instrument performs effectively at voltages of 3.05 kV up. The authors thank M. D. SHAFRANOV, R. S. RADZHABOV and T.F.SAPOZHNIKOV for supplying the necessary equipment and for the help in testing the electronic circuits with a proportional chamber. Figures 7; references: 6 Russian.
[15-2415]

UDC 620.178.5.05

MULTICHANNEL EQUIPMENT FOR DETERMINING THE DYNAMIC CHARACTERISTICS OF MECHANICAL STRUCTURAL COMPONENTS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 7, Jul 79 pp 26-27

SMILGA, V. I., candidate in physicomathematical sciences, VASIL'YEV, K. I., SMIRNOV, YU. A. and YAZVIN, V. M., engineers

[Abstract] The article describes the AVDI-2N system for dynamic testing of mechanical structural members. The system contains devices for multipoint excitation of oscillations, and also includes a complete unit for measurement and registration. Vibrations can be induced at up to twenty points of the test structure, and registration is either by an alphanumeric printer and tape puncher, or by an oscilloscope display and a two-coordinate plotter. A master oscillator is used for vibrating the structure in resonant tests. The force characteristics of the excitation device: frequency range 1-300 Hz, amplitude of individual forces up to 100 kgf, displacements at points of excitation up to 20-30 mm, error about 1 percent. 3 figures, 4 references: 2 Russian, 2 Western.
[16-2415]

UDC 534.117.135.088

MEASURING ACOUSTICAL AND VIBRATIONAL CHARACTERISTICS OF [illegible]

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 7, Jul 79 pp 27-28

[illegible], V. N., engineer

[Abstract] This research has not been performed before; the relationships derived can be viewed as mathematical models for designing and planning electrostatic kilovoltmeters. The technical and economic suitability of a certain device must be determined; it is necessary to know the characteristics of other, similar models to make the best choice. Sixty-five models (120 modifications) of domestic and foreign electrostatic kilovoltmeters were considered. The upper limits of measurement of electrostatic devices lie between 0.01 and 600 kilovolts. Processed findings are presented in graphic form depicting the linear spectrum of upper measurement limits. These values correspond to some preferential numbers adopted as standards in each country and do not reflect the actual distribution of need; the spectral density is not a consistent evaluation of the distribution. To make the evaluation consistent, the procedure of smoothing with moving averages was employed. The averaging window corresponded to a Gaussian curve. Processing was done on a Mir-2 computer in ANALITIK language. Analysis in terms of overall dimensions and weight yielded two compact subgroups of devices. Input capacitances ranged from 20-200 picofarads, with minimum voltages of 5-6 kV. For most upper measurement limits, kilovoltmeters could be designed with an input capacitance near 10 picofarads which would be suitable for measuring high-frequency voltages. Figures 6; references: 2 Russian.
[641-8617]

UDC 621.317.727.2:681.92

[illegible]

[illegible] IZMERITEL'NAYA I SISTEMY UPRAVLENIYA in Russian No 7, Jul 79 pp 22-24

[illegible], Dr. A. and [illegible], A. N., candidates in technical sciences, [illegible]

[Abstract] An examination is made of automatic measuring instruments with [illegible] pulse-modulation converters. Inverters with PDM and PCM are [illegible]. Various techniques are considered for pulse shaping [illegible] electronic inverter with PDM. An inverter with PCM is considered [illegible] from [illegible] used. An analysis of the metrological and dynamic [illegible] of automatic measuring instruments with pulse-modulated inverters shows that these analog-digital devices have advantages of accuracy, [illegible] and reliability. Figures 5; references 5: 2 Russian, 3 Bulgarian.
[8544-8617]

USSR UDC 681.33

THE FUNCTIONAL CAPABILITIES OF MICROELECTRONIC RESISTIVE ARRAYS

Avtometriya in Russian No 3, May/Jun 79 pp 120-122 manuscript received 18 May 77

ARUTYUNOV, V. L., KOPEYKIN, G. A. and SHALITO, A. A., Leningrad

[Abstract] An estimate is made of the functional capabilities of sets of identical resistors with a limited number of external contact from the body of the integrated microcircuit which contains them. A series-connected chain of k identical resistors allows a large number of different resistances to be achieved with an unusually small number of external terminals. For example, where k = 7, 179 of 180 possible structures can be realized with k + 1 connections, rather than 2k, as with more conventional designs. Figures 2; references: 4 Russian.
[3-6508]

USSR UDC: 681.327.17

AN OPTICAL RADIATION PULSE GENERATOR WITH DIGITAL CONTROL

Novosibirsk AVTOMETRIYA in Russian No 3, May/Jun 79, pp 95-98 manuscript received 12 Jan 79

MATYUKHINA, V. M., REBITVA, V. N., FIGUROVSKIY, YE. A. and KHUSAINOVA, YA.G., Novosibirsk

[Abstract] The use of lasers with electrooptical and acoustooptical modulators does not satisfy the demands for generation of pulsed radiation for the study of individual photoreceptors and matrices of photoelectric converters. Significantly better results can be achieved by the use of high speed injection diodes based on gallium arsenide and phosphide. This work describes a pulsed optical radiation generator which operates by simultaneous excitation of 30 injection diodes with subsequent addition of their radiation by a collecting lens. For better matching, each diode is equipped with an individual condensor, allowing the variation in focal length and numerical aperture of the radiating crystal of each diode to be considered by adjustment of the condensor. Operation and adjustment of the devices are described. Figures 3; references: 4 Russian.
[7-6508]

USSR UDC 621.373

A HIGH-EFFICIENCY THYRATRON GENERATOR OF HIGH-POWER NANOSECOND PULSES

Minsk IZVESTIYA V TOMSKOM ORDENA TRUDOVOGO KRASNOGO ZNAMENI POLITEKHNICHESKOGO INSTITUTA IMENI S. M. KIROVA in Russian No 4, Jul-Aug 79 pp 178-181 manuscript received 6 Mar 78; after modification 4 Jul 78

[illegible], V. A., [illegible], N. A., OPAL, V. P. and ZHUKOVSKIY, V. P., Scientific Research Institute of Nuclear Physics, Tomsk Polytechnic Institute

[Abstract] A high-power generator of nanosecond pulses has been built with [illegible] storage and load lines and a ferrite core, according to Yu. V. [illegible], but characterized by a higher efficiency and a lower ratio of commutation current to load current. A generated pulse is transmitted to the load resistance and the negative pulse reflected at the short-circuit line [illegible] in the opposite direction to be absorbed by a matching load, while a positive pulse delays discharge through this matching load till the next forward pulse arrives. An experimental generator with a TGI1-2500/50 thyratron as commutator in a coaxial pack operated for 200 h delivering 4J pulses at a repetition rate of 100 Hz, while, with water cooling of the [illegible], could be raised to 400 Hz. Figures 2; references: 6 Russian.
[7-6509]

USSR

UDC 535.2:621.383+621.383.181.45

A UNIVERSAL DEVICE FOR THE STUDY OF p-CHANNEL PHOTOELECTRIC TRANSDUCERS BASED ON CHARGE-COUPLED DEVICES

Novosibirsk AVTOMETRIYA in Russian No 3, May/Jun 79 pp 69-74 manuscript received 23 Nov 78

FIGUROVSKIY, Yu. A., KHLABOV, V. A., Novosibirsk

[Abstract] The development and actualization of the principles of design of a universal multicycle device for matrix and linear 2- and 3-phase p-channel CCD with various information capacities are described. The devices are suitable not only for the construction of photo-electric transducers, but also for studies of the properties and measurement of the parameters of experimental CCD devices. A control device is produced with the following characteristics: maximum reading frequency 1 MHz, clock pulse leading edge length < 50 ns, minimum frame frequency 0.1 Hz, limit of regulation of control constants and pulse voltages 0--20 V, load capacity of output pulse devices up to 1000 pf, video control device power nonlinearity 5 percent, maximum information capacity of transducer 256 X 256 bits. A control device refers to an electronic device allowing the frequency of reading and frame frequency to be altered broadly, permitting 2- and 3-phase linear and matrix CCD with information capacities of up to 2^{16} bits to be studied, with independent regulation of all control voltages and forms of clock pulses, permitting reading both directly and with intermediate storage of information while preserving geometrically correct scanning of the video control device regardless of the variations in the factors named above. Figures 2; ref-reuses: 4 Russian.
[-6508]

USSR

UDC 621.382

OPTIMAL OPERATING MODE OF A SEMICONDUCTOR SWITCHING DIODE IN MATRIX CHARGE-COUPLED OPTICAL INFORMATION TRANSDUCERS

Novosibirsk AVTOMETRIYA in Russian No 3, May/Jun 79 pp 13-17, manuscript received 25 Dec 77, final version, 12 May 78

KHALIN, V. P., PETROVSKIY, I. P., Novosibirsk

[Abstract] The purpose of this study was to determine the minimum permissible value of relative switching charge for various lengths of the reading time and various values of the parameter of the switching diode τ, and also to determine the shape of the charge current pulse for which this minimum value is realized. Requirements for the shape of the reading voltage pulse

to assure passage of the optimal current pulse through the diode are also determined. When pulses of a special form are used, very high reading speeds can be achieved while maintaining satisfactory signal/noise ratios in diode-diode photo-and electron-receiving matrices: a signal to noise ratio of 2 to 1 can be achieved with an interrogation time of 10 ns and a switching diode parameter τ of 40 ns. References 6: 4 Russian, 2 Western. [20-6508]

UDC 621.383

MATRIX VACUUM-SEMICONDUCTOR PHOTO RECORDERS

Novosibirsk AVTOMETRIYA in Russian No 3, May/Jun 79 pp 3-13, manuscript received 21 Nov 78

ABAKUMOV, V. F., ANSTERIKHIN, YU. YE. and TSUKERMAN, V. G., Novosibirsk

[Abstract] An analysis is presented of the matrix-type vacuum-semiconductor photo recorders. They are divided into direct-reading (mosaic) type instruments and devices with information storage (matrix-type). The vacuum-semiconductor photo recorders with electric reading, a combination of proven materials, electronic image amplifiers and semiconductor electron-sensitive integrated circuit has eliminated the greatest shortcoming of earlier devices--their low sensitivity. This work describes the principles of creation of vacuum-semiconductor photo recorders with rapid information readout, based on integrated diode-diode electron receptor matrices. The 16 X 16 element matrices which have been developed have a sensitivity on the order of 10^{-16} J/el, information reading X 700 ns, and the devices are quite suitable for recording of rapidly occurring processes in situations where high spatial resolution is not required. Figures 7; bibliography 10 titles, 6 Russian, 4 Western.
[20-6508]

UDC: 621.383.181.48+681.327.65.778.38

[illegible] CHARACTERISTICS OF A SEMICONDUCTOR PHOTOELECTRIC MATRIX

[illegible] AVTOMETRIYA in Russian No 3, May/Jun 79 pp 45-50 manuscript [illegible] 78

[illegible], B. ..., Novosibirsk

[Abstract] [illegible] the results of the static and photoelectric characteristics of experimental models of semiconductor [illegible] photo diode matrices

designed for use in multiple-element hybrid integrated photoelectric transducers in optical memories and computers. A photograph of a matrix with 48 outputs is presented. The spacing between diodes on the 5 X 5 mm^2 crystal is 0.25 mm, each diode measures 0.1 X 0.1 mm^2. The matrix is organized into 16 16-bit words. Matrices of this type were used in the creation of experimental hybrid-integrated photoelectric transducers with capacities of 1024 (32 X 32) at 16384 (128 X 128) bits. The characteristics of the photocell are presented. Limitations on the electrical operating mode are noted. The sensitivity varies from $2.6 \cdot 10^{10}$ to $9.6 \cdot 10^{10}$ V/J, the dynamic energy range varies from 1.1 to 7.2 times. The best relationship between output dark signals and dispersion is achieved with the power supply voltage of -12 V, the greatest photo sensitivity--at -15 V. Figures 3, references 8: 4 Russian, 4 Western.
[4-6508]

USSR UDC: 621.383.181.48:681.327.68:778.38

A MEASUREMENT DEVICE FOR THE STUDY OF MATRIX PHOTOELECTRIC CONVERTORS WITH COORDINATE CONTROL

Novosibirsk AVTOMETRIYA in Russian No 3, May/Jun 79 pp 63-69
manuscript received 2 Mar 78

KASHLATYY, R. YE., FIGUROVSKIY, YE. A., [illegible]AINOVA, YA. G., Novosibirsk

[Abstract] A study is presented of the principles of design of a universal measuring device for the study of characteristics of photoelectric transducer matrices with information capacities of up to 10^4 bits. The principles are illustrated on the example of a control device for a square matrix with a capacity of 16 X 16 bits. The matrix has the capacity to be expanded to 128 X 128 bits. The frame frequency is fixed at 900 Hz or 10 KHz. Reading times are 1.0 and 0.3 μs. The storage times are 80 μs or 1.0 ms. Figures 5; references 7: 6 Russian, 1 Western.
[2-6508]

USSR UDC: 621.383.292:681.327.68.778.38

VACUUM PHOTODETECTORS FOR OPTICAL-ELECTRONIC COMPUTER MEMORY DEVICES

Novosibirsk AVTOMETRIYA in Russian No 3, May/Jun 79 pp 17-19 manuscript received 20 Feb 78

MECHETIN, A. M., MILYUTIN, V. I., FEDOROV, V. YU., Moscow

[Abstract] A multichannel vacuum photodetector is suggested, consisting of a photo cathode, focusing and deflecting systems and an electron detector. The low dark current of the photo cathode and internal amplification of photo electron energy allows threshold energy sensitivities on the order of 10^{-15}-10^{-16} J/bit to be achieved, which is close to the theoretical maximum possible sensitivity. The authors have created two versions of such devices. The first uses a low-inertia cathode-luminescent screen as the electron detector; the second uses a semiconductor mosaic matrix of pin diodes. Both can read 96 X 96 elements of information with 256 positions of deflection, and could be widely used for recording, conversion and amplification of the energy of objects with low luminescence. Figures 3; references: 4 Russian.
[2-6508]

USSR UDC: 621.383+681.327.68:778.38

A LIGHT-SENSITIVE FLIP-FLOP, THE BASIC ELEMENT IN LARGE-VOLUME PHOTO DETECTING MATRICES FOR OPTICAL MEMORIES

Novosibirsk AVTOMETRIYA in Russian No 3, May/Jun 79 pp 61-63 manuscript received 2 Mar 78

GUSEV, V. K., TOLSTOGANOV, V. K., SHILOV, I. A., Moscow

[Abstract] A light-sensitive flip-flop with a very simple circuit is described. A schematic diagram and time diagram of the operation of the light-sensitive flip-flop are presented. The devices utilizes 2 diodes, 4 transistors, and a resistor. The energy sensitivity varies with the amplitude of the erase pulse and the capacitance of one of the photo sensitive diodes. The sensitivity of the device is limited by thermal noise, variations in the electrical parameters of paired elements of the device code-dependent time noise (prehistory) and code-dependent space noise, resulting from parasitic (usually capacity) coupling with neighboring flip-flops. Figures 2; references 3: 2 Russian, 1 Western.
[2-6508]

USSR UDC: 551.594.2.001.55

OPTICAL-OSCILLOGRAPHIC STUDY OF LIGHTNING DISCHARGES

Baku DOKLADY AKADEMII NAUK AZERBAYDZHANSKOY SSR in Russian Vol 35, No 1, 1979 pp 45-49 manuscript received 17 Apr 78

ALIZADE, A. A., corresponding member, Azerb SSR Academy of Sciences, and KHYDYROV, F. L., Institute of Power Engineering imeni Yes'man

[Abstract] The results are presented of an analysis of a long term study of various parameters of lightning discharges, performed by optical and oscillographic methods in special structures in a field laboratory in the city of Shushi. Various designs of cameras with time scans were used to study repeated discharges and lightning leaders. Twenty-four scans of cloud-to-surface and 13 scans of cloud-to-cloud discharges were analyzed. The differences between the two types of discharges are noted. The apparatus developed at the authors' laboratory allow simultaneous recording of the optical and oscillographic parameters of discharges. The shape of the voltage wave of the electric field of cloud-to-ground discharges differs from that of cloud-to-cloud discharges, having a sharper leading edge and trailing edge. Figures 2, references 7: 3 Russian, 4 Western.
[1-6508]

USSR UDC 621.3.017:681.32

EMPLOYMENT OF COMPUTERS FOR CALCULATING ELECTRIC POWER LOSSES IN THE ROSTOV POWER SYSTEM

Moscow ENERGETIK in Russian No 7, 1979 pp 21-22

YELAGINA, S. P., engineer, Rostovenergo Rayon Power Administration, Rostov-na-Donu

[Abstract] A computer began to be used in the Rostov Power System in 1970 for the purpose of calculating performance, including power losses. A "Minsk-32" computer was introduced in 1973 and now performs the following calculations for the purpose of reducing losses in networks: for working o out the optimal operating mode for 110 kV networks and higher, for reducing losses in the power system when new projects are added, for working out seasonal conditions for the purpose of selecting the position of transformer taps, for the selection of generators for operation in the static capacitor mode, for calculating the increase in losses when static capacitors are shut off and certain 220-110 kv lines are turned on, and for calculating complex maintenance procedures for the purpose of guaranteeing reliability

of the power supply and the absence of impermissible overloads. The "Elektroset'" [Electrical Network] group of programs from Irkutsk Polytechnical Institute is used to make these calculations, which are performed every day. Twice a year, using program B-2/77 of the main technical administration computer center of VNIIE [All-Union Scientific Research Institute of Electric Power Engineering], a calculation is made of the steady-state performance of the power network, entailing optimization in terms of voltage, reaction power and transformer transformation ratios. For the latter purpose computers of outside organizations are used. Calculations made with the computer are used to make a systematic structural analysis of losses in networks, to evaluate the technical and economic effectiveness of measures planned for reducing losses, to predict losses, to determine the effectiveness of the spacing of static capacitors, to write recommendations for the power system's operating modes, and to make suggestions for introducing new generating capacities, overhead lines and substations. As a result, the actual reduction in electric power losses in the power system in 1978 equaled 81 million kWh. In spite of this, losses in the power system's networks are still too high. The employment of computers makes it possible to take measures to ensure technically achievable minimum losses. The electric systems and networks department of Novocherkassk Polytechnical Institute is in 1979 making a study to determine power and energy losses in electrical networks of the Rostovenergo system, including the development of applied programs for planning optimal modes for reducing power and energy losses. The necessity for reliable raw data has resulted in measures being taken in the power system to increase accuracy in keeping electric power records.

USSR UDC 621.311.41.072.2

AUTOMATIC FORCING OF STORAGE BATTERY VOLTAGE

Moscow ELEKTRICHESKIYE STANTSII in Russian No 7, Jul 79 pp 62-65

TSIREL', YA. A., candidate in technical sciences, and BOGURDOVICH, YU. V., engineer, Leningrad High-Voltage Network, Lenenergo

[Abstract] The storage batteries in substations are sometimes called upon to handle surge loads of up to several hundred amperes, such as those produced by the electromagnetic drives of oil circuit breakers. The DC circuits used in the battery system utilize a device described in this paper for automatic high-speed voltage forcing. In the case of a surge load, this unit almost instantaneously increases the number of cells of the battery that are connected to the DC buses, thus compensating for the voltage drop in the elements of the DC network. A thyristor is used in commutation to ensure speed of action. The battery is divided into main and auxiliary groups of cells, the auxiliary group being connected only to the

circuit with the surge load. The bus sections to which these groups are connected are coupled through the thyristor and a parallel-connected contactor. In the absence of surge loads, the contactor is open and the thyristor is blocked. If a surge in either section causes a dangerous voltage drop in the first section, a special sensor acts on the controlling electrode of the thyristor, unblocking it and connecting the first section to the auxiliary group of battery cells. The same sensor closes the contactor with a time delay, shunting and closing the thyristor, so that the thyristor has to handle the full current only momentarily. Tables are given summarizing the characteristics of various modifications of the device. Figures 4; references: 2 Russian.
[280-6610]

USSR UDC 621.316.542.064.241:621.316.8

INVESTIGATION OF THE ELECTRICAL CHARACTERISTICS OF BETEL SHUNTING RESISTORS

Moscow ELEKTRICHESKIYE STANTSII in Russian No 7, Jul 79 pp 57-60

MANCHUK, R. V., KOVALEV, B. I., candidates in technical sciences, KHROMOV, V. G., engineer, and MILEVSKIY, A. K., candidate in technical sciences, Siberian Scientific Research Institute of Power Engineering

[Abstract] The use of shunting resistors on high-voltage breakers damps the transient process of voltage recovery across the contacts when disconnecting short-circuit currents, and hence improves the tripping capability of equipment. The shunting resistors used in updating air circuit breakers of the VVN type are commonly made of Betel, a composition material made by the Siberian Scientific Research Institute of Power Engineering [see "Conductive Composition Materials Based on a Cement Binder," Trudy SibNIIE, 1964, No 2(21)]. The RBShN Betel resistors made for this purpose are produced by the Energotekhprom Experimental Engineering Production Enterprise. The Betel shunting resistors are made of several series-connected elements, each of which consists of 8 disks 20 cm in diameter and 10 cm high. This paper gives the results of a study of the electrical characteristics of Betel shunting resistors in transient modes. It was found that when high voltage is applied to the Betel resistor, its resistance may fall to half the initial value. Thus a shunting resistor reduces the rates of change and amplitudes of high voltages across the switch contacts. The electrical characteristics of Betel resistors depend not only on the amplitude, but also on the rate of change in the restored voltage; however, the rate dependence in resistors that are actually used is insignificant and can be disregarded in voltage analysis. The type of nonlinearity of Betel shunting resistors is conducive to successful operation of the circuit breaker. An abrupt initial drop in resistance causes more intense damping of high

voltages, and hence facilitates conditions of arc quenching on the main contacts; a rise in resistance to the initial value as the limited current approaches zero somewhat facilitates the operation of the isolator. Determination of the optimum electrical characteristics of Betel shunting resistors necessitates an investigation of the influence that the nonlinearity of Betel has on the nature of voltage recovery, and on the processes of arc quenching across the main contacts and the isolator contacts. Figures 5; references: 4 Russian.
[280-6610]

USSR UDC 631.371:621.316.1

ANALYSIS OF THE FAULT RATE OF LINES AND WAYS OF IMPROVING THE RELIABILITY OF THE POWER SUPPLY FOR RURAL CUSTOMERS IN THE LATVIAN SSR

Moscow ENERGETIK in Russian No 7, 1979 pp 22-24

PETROV, V. V., candidate in technical sciences, Daugavpils

[Abstract] Statistical data are given on the fault rate in the 0.38/0.22 kV distribution network in Daugavpilsskiy Rayon without taking into account faults in substations, distribution boards and in user's facilities. Figures are based on an analysis of journal entries for 1975-1978 and the length of the electrical network in the area where the studies were made represents 1800 km of 0.38/0.22 kV overhead lines and 680 km of 20 kV overhead lines. Data are also presented on the length of the working day of key consumers of electric power in agriculture with an indication of permissible interruptions which will not be of harm to the area studied. It is concluded from these data that the performance of work in a distribution network at any time of the day entails the inadequate distribution of power to customers. It is shown that the periods of the greatest harm to customers coincide exactly with the most convenient periods for performing maintenance and overhaul work on electrical networks. The mean value of the unit loss from interruptions in the power supply to rural customers for the Latvian SSR has equaled 0.42 rubles per kilowatt-hour. At the present time an average of 1.3 production areas is affected by a single 0.38/0.22 kV overhead line cutoff. The mean number of interruptions in electrical service per year per production unit varies within the range of 0.153 to 0.281 with an average shutdown time of 4.25 h. This represents an annual equipment downtime per production unit of 0.65 to 1.19 h. It is concluded that urgent measures are necessary to improve the reliability of electrical service to customers. The most effective means to do this is to use mobile 10 to 50 kW power plants. These, however, are presently being produced in too small quantities. The number of customers cut off at a single time can be reduced by sectioning 0.38/0.22 and 20 kV overhead

lines and converting them to a closed-circuit operating mode. The most economical for 20 kV networks is to introduce automatic sectioning with remote control by radio. The radii of electrotransmission lines can be reduced, with a consequent improvement in the reliability of electrical service, by erecting new 110/20 kV substations, although this measure is expensive. Nevertheless, work is being done along this line. Scheduled cutoffs of electrical service now equal 81 percent of the total. Figures 1; tables 2

USSR UDC 621.374

A LOW-IMPEDANCE TRANSMISSION LINE WITH FERRITE CORES FOR STEEP GRADIENTS OF ELECTROMAGNETIC POWER

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 4, Jul-Aug 79 pp 172-173 manuscript received 6 Feb 78; after modification 21 Nov 78

DUBNEV, A. I. and KATAYEV, I. G., Gorkiy Polytechnic Institute

[Abstract] An artificial line with ferrite cores for steep gradients of electromagnetic power has been designed which has both a low characteristic impedance and a high dielectric strength. This is achieved by placing annular ferrite cores inside cup shields in contact with the inside conductor but insulated from the outside copper or brass conductor by a wrap of polyethylene tape. The entire coaxial assembly is impregnated with an organosilicon fluid. The time constant of such a line must be much shorter than the front of an electromagnetic shock wave. Such a line 200 mm long with a characteristic impedance as low as 5-8 Ω and a time constant of 0.22 ns per segment, thus a bandwidth of 5 GHz, was actually built using 0.16VT K7x4x2 annular cores. Figures 1; references: 4 Russian. [18-2415]

USSR UDC: 62-504:621.376.54

EXISTENCE OF PERIODIC MODES IN SYSTEMS WITH INTEGRAL PULSE-WIDTH MODULATION

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 7, Jul 79 pp 175-181, manuscript received 28 Jun 78

ANTONOVA, N. A., Syktyvkar

[Abstract] A study is made of a pulse-width modulation system, seeking a periodic solution with the property that the output of the linear section is a periodic function while the modulated parameter is constant. Two theorems are given which describe the relationships between system parameters for which the periodic mode exists. References: 2 Russian.
[284-6508]

USSR UDC 621.374.5

A PRECISE AND SMOOTH WIDE-RANGE DELAY REGULATOR FOR NANOSECOND LOGIC PULSES

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 4, Jul-Aug 79 pp 175-178 manuscript received 23 Feb 78

MOROZOV, A. G.

[Abstract] A device has been built for smoothly regulating the delay of nanosecond logic pulses from less than 100 ns up to 5 μs. It includes a 100 MHz reference-pulse generator, a set of three synchronizing triggers, the first one also a blocking trigger, a counter, two AND circuits, one OR circuit, a variable-voltage generator with a lower-level and an upper-level discriminators, an output pulse shaper, an amplifier, and a reset pulse splitter with a univibrator. Most components are built on series 138 integrated microcircuits, some triggers use tunnel diodes, and there are four transistor switches. Some leakage current lowers the capacitor voltage during conversion of time interval to voltage amplitude so that the delay is somewhat shorter than nominal, but not by more than 0.01 percent. There is also some delay drift due to temperature fluctuations, but not more than 50 ps/°C at the 5 μs top level. The author thanks A.A. VORONIN, YE. A. MELESHKO, G. N. SOFIYEV for interest and helpful comments, and V. N. TKACHEV for technical assistance. Figures 3; references 5: 4 Russian, 1 Western.
[18-2415]

USSR UDC 621.374.325:550.832.5

A LEVELER OF STATISTICALLY DISTRIBUTED PULSES

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 4, Jul-Aug 79 pp 125-127 manuscript received 21 Feb 78

IL'KANAYEV, G. I., ISKENDEROV, V. G. and MELIKOV, G. L.

[Abstract] Leveling of statistically distributed pulses is the best method of avoiding losses in a count, provided that positive spikes during fluctuation of recorded pulse do not result in overflow of the first storage counter. An earlier developed leveling device has been improved in this respect, it also has a simpler structure and performs the conversion very accurately. The device consists of a storage register with a JK-trigger and three other triggers, a NAND cell, a stroke pulse generator and a generator of short pulses. The components are built on series 133 and 134 integrated microcircuits. The probability of miscount is theoretically 0.694 percent and 0.09 percent with a memory capacity of 3 or 4 respectively, at a 0.3 ratio of average count rate to interrogation frequency. In a test the actual miscount was 0.75 percent and 0.045 percent respectively. Figures 2; references 5 Russian.
[18-2415]

USSR UDC 621.315.592

TEMPERATURE STUDIES OF PHOTOELECTRIC AND OPTICAL PROPERTIES OF CHALCOGENIDED VITREOUS SEMICONDUCTORS IN THE SYSTEM As-S

Novosibirsk AVTOMETRIYA in Russian No 3, May/Jun 79 pp 78-85,
manuscript received 6 Oct 78

D'YACHENKO, N. G., KARNATOVSKIY, V. YE., MANDEL', V. YE., TYURIN, A. V., TSUKERMAN, V. G. and SHCHEVELEVA, A. S., Novosibirsk-Odessa

[Abstract] This work is dedicated to the study of the mechanism of highly effective temperature recording of holographic information on monolithic materials in the system As-S. Combined temperature studies of photoelectric and optical properties of specimens subjected to preliminary heat treatment were performed. It is assumed that in nonstoichiometric materials in the system, the sulphur atoms with various bond configurations are the centers of capture of the nonequilibrium carriers. For certain defect contents, composition and pre-history of the materials at certain temperatures, the configuration of S^- capture centers formed by defect sulphur atoms may be significantly greater than the concentration of centers formed by regular atoms. In any case the capture cross section of acceptor S^- centers in defective areas is probably greater than in regular atoms. Figures 9; references 8: 3 Russian, 5 Western.
[2-6508]

USSR UDC 621.373.535.06

DIELECTRIC LASER MIRRORS WITH AMPLITUDE HETEROGENEITY

Novosibirsk AVTOMETRIYA in Russian No 3, May/Jun 79 pp 92-95
manuscript received 6 Apr 78; in final version 27 Jul 78

NIKITENKO, A. G., TROITSKIY, YU. V., Novosibirsk

[Abstract] A study is made of the problem of manufacture of equiphase mirrors with amplitude transmission coefficient which changes in steps. A new method is suggested for manufacture of heterogeneous mirrors, in which high transmission contrast is achieved with a difference in the number of quarter wave layers of only one. A diagram of the mirror and a graph of transmission and absorption as functions of the number of layers in the first stage of atomization are presented. The method suggested allows easy production of equiphase heterogeneous reflectors with sharp boundaries between areas and high transmission contrast. One shortcoming of the mirrors produced is their resonant nature, somewhat increasing the losses to absorption in the layers. Figures 2; references 9: 7 Russian, 2 Western.
[2-6508]

USSR UDC 621.378.001

SWITCHING OF AN ELECTROOPTICAL ELEMENT BASED ON A TYPE TSTSL FERROCERAMIC WITH A HIGH FREQUENCY FIELD

Novosibirsk AVTOMETRIYA in Russian No 3, May/Jun 79 pp 101-104 manuscript received 17 Aug 78; final version, 8 Dec 78

ZHABOTINSKIY, V. A., UL'YANOV, B. V., YASHIN, E. M., Moscow

[Abstract] A study is made of the possibility of creation of devices in which material is shifted to the thermally depolarized state by means of a high frequency electric field. The use of such devices is recommended for optical information processing systems in which the speed of one write-erase cycle need not exceed $5 \cdot 10^{-2}$ s. Contrast levels of 5:1 or more can be achieved. Light transmission reaches 65%, and can be increased to almost 100 percent by the use of antireflection coatings. Figures 2; tables 1; references 9: 2 Russian, 7 Western.
[2-6508]

USSR UDC 621.378.32

USE OF CADMIUM-SELENIUM GLASSES FOR PASSIVE SHUTTERS IN GENERATORS OF SUPERSHORT PULSES

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 4, Jul-Aug 79 pp 226-227 manuscript received 15 Mar 78

KORDA, I. M., Institute of Physics, Academy of Sciences of the Belorussian SSR, Minsk

[Abstract] The feasibility of fast transition of a ruby laser with mode locking from subnanosecond monopulse to pulse train emission has been demonstrated experimentally with the use of KS-18 or KS-19 glass for the passive shutter and with total internal reflection in the resonator cavity. All surfaces of the resonator elements were oriented at the Brewster angle relative to the cavity axis and a 3 mm or 1.5 mm thick passive glass shutter was located near the opaque concave mirror. An analysis of the processes is difficult, because of insufficient available data on the glass composition, but pulses of 2.5 ns duration and up to 0.5 J energy can be generated. With a 2-element pile inserted between the shutter and the active medium, and with a 20-30 percent higher pumping threshold, it has been possible to generate 30 ns monopulses of up to 0.7 J energy. Figures 1; tables 1; references 8: 6 Russian, 2 Western.
[18-2415]

USSR UDC: 62-506:629.7.05

RECURRENT SEARCH EVALUATION AND SYNTHESIS OF ALGORITHMS FOR CORRELATION-EXTREMAL NAVIGATION SYSTEMS

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 7, Jul 79, pp 68-79
manuscript received 5 May 78

BELOGLAZOV, I. N., YERMILOV, A. S., KARPENKO, G. I., Moscow

[Abstract] The particular case of a discrete nonlinear system is studied, in which the equations of motion and observations depend nonlinearly on the portion of the phase coordinates which performs free motion. It is demonstrated that recursive-search estimation can be used to estimate the coordinates in navigation systems which seek the extreme of correlation. A recursive search algorithm is presented for estimation of the coordinates in such systems. Figures 8; references: 12 Russian.
[284-6508]

USSR

ELECTRONIC WAREFARE IN THE PLANS OF THE PENTAGON AND NATO

Moscow RADIO in Russian No 7, Jul 79 pp 56-58

GRANKIN, V., doctor in military sciences, Professor

[Abstract] A brief survey of Western literature dealing with offensive and defensive electronic warfare. Emphasis is placed on devices and techniques used in jamming and deception. Specific examples are given of some of the more sophisticated devices, and the principles of operation are explained. Figures 3; references: 11 Western.
[279-6610]

USSR

STUDY OF THE INFLUENCE OF ELECTROMAGNETIC RADIATION ON THE PROCESS OF GROWTH OF EPITAXIAL LAYERS IN NARROW-ZONE SEMICONDUCTORS

Baku DOKLADY AKADEMII NAUK AZERBAYDZHANSKOY SSR, in Russian Vol 35, No 1, 1979, pp 25-30 manuscript received 8 Apr 78

GURO, G. M., KALYUZHNAYA, G. A., MAMEDOV, T. S., SHELEPIN, L. A., Institute of Physics imeni P. N. Lebedev, USSR Academy of Sciences

[Abstract] A description is presented of studies of the influence of light radiation on the growth and properties of PbTe, $Pb_{1-x}Sn_xTe$, HgTe and CdTe layers produced by gas epitaxy, and the possible mechanisms involved are analyzed. The source of radiation was a high pressure xenon lamp radiating light at 0.2 to 1.5 μm, with 10 percent of the power in the UV zone, 35 percent in the visible zone and 55 percent in the IR zone. It is found that combined use of UV and IR radiation has a stimulating effect on crystallization of layers, increasing the growth rate by an order of magnitude and improving the structure of the layers generated. Figures 2; tables 1; references: 10 Russian.
[1-6508]

USSR UDC 621.317.757/088.8

INVESTIGATION OF EFFECTS OF QUANTIZATION OF HARMONIC COEFFICIENTS IN FAST FOURIER TRANSFORM PROCESSORS

Kiev IZV.VUZ: RADIOELEKTRONIKA in Russian Vol 22, No 7, Jul 79 pp 38-44
manuscript received 14 Feb 78; after revision, 24 Apr 78

GALAGAN, V. G. and SHUBS, YU. V.

[Abstract] A statistical method is applied to a description of the effects of quantization of weighted Fourier coefficients in realization of the fast Fourier transform. The proposed technique is accurate and suitable for analyzing an extensive class of steady-state random processes. A comparison of theoretical and experimental error curves shows deviations of the maxima for quantization errors on the central frequency of no more than 1 percent, which is within the range of statistical variability. Combined use of a mathematical model and the proposed statistical method provides a quite accurate description of the actual processes of error development in fast Fourier transform processors that are due to quantization of the harmonic weighted coefficients. The derived formulas give a convenient means of evaluating the distribution of errors with respect to frequency when the spectral or correlation function is known for the process to be analyzed. Figures 4; references 2: 1 Russian, 1 Western.
[6610-268]

USSR

ESTIMATING THE RELIABILITY OF ONE CLASS OF COMPLEX SYSTEMS

Moscow TEKHNICHESKAYA KIBERNETIKA in Russian No 4, Jul-Aug 79 pp 205-208
manuscript received 12 Apr 77

REVYAKOV, M. I., Leningrad

[Abstract] The reliability of a system consisting of n independent components and performing m different functions is estimated as the criterion of failure serving a drop of the system efficiency below a permissible level. Under consideration is the additive case, where performance of any one function adds a corresponding definite amount to the overall system efficiency. The calculations are referred to the efficiency of an ideal system equal to 1. The efficiency of a real system is treated as a random quantity, with two random vectors for $j = \overline{1,n}$ and $i = \overline{1,m}$ respectively. Its moments are calculated and reliability ranges are established depending on these moments, under certain constraints with regard to the probabilities

characterizing the (i,j) pairs. This procedure yields lower and upper estimates of the system reliability which can be further narrowed down, depending on those constraints. Such an estimation, programmable on a computer, is illustrated here on a specific case of a matrix-type commutator with a 15x8 matrix transmitting 120 useful signals from probes to an instrument such as a digital bridge circuit through relay banks. The accuracy of an estimate can be improved by including successively higher-order moments of the efficiency distribution. Figures 1; references: 4 Russian. [11-2415]

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